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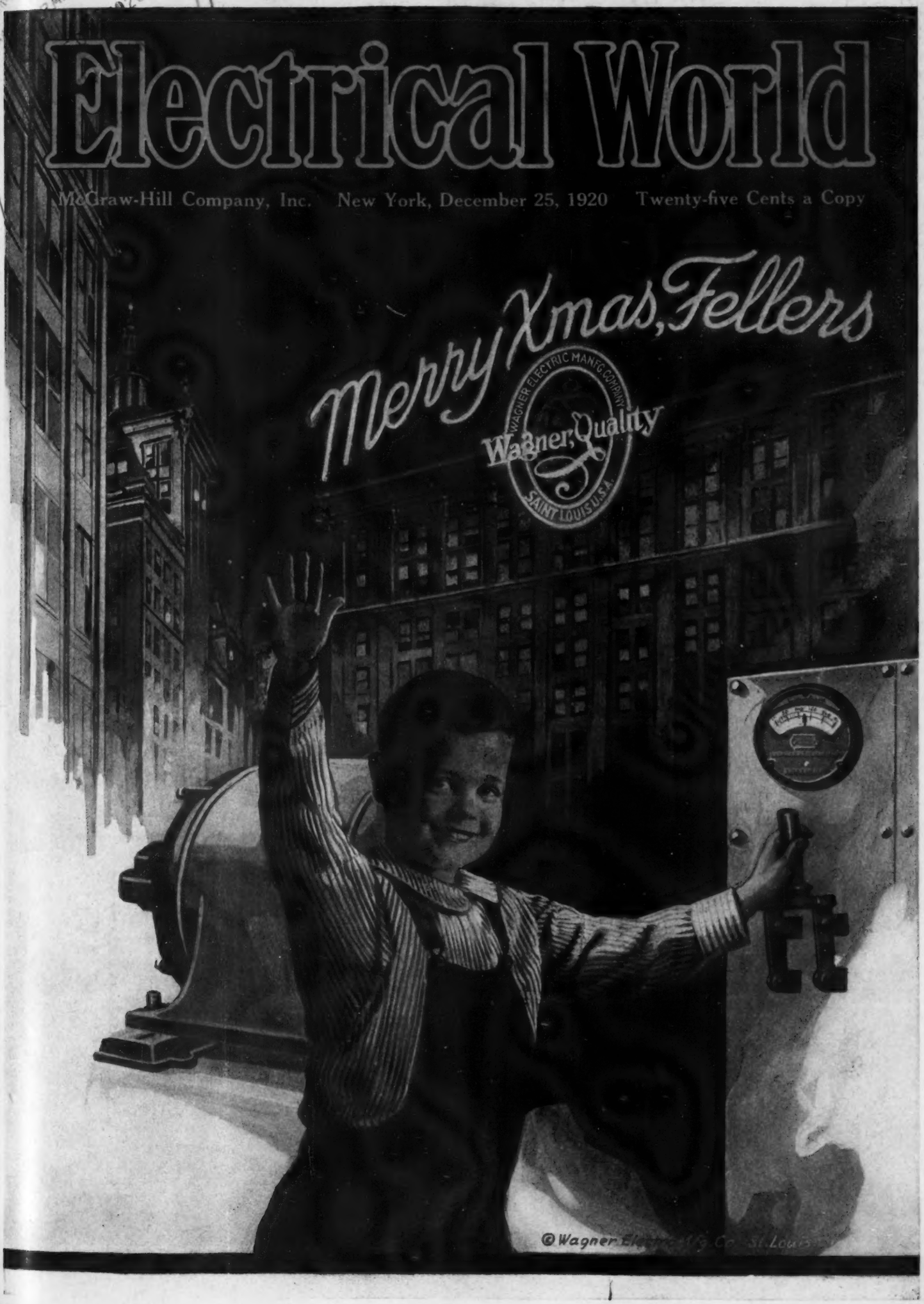

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Cheerfulness as an Antidote to Depression

CHRISTMAS is always associated with joyfulness and happiness. Its sentiment grips the heart and stirs the will of even the most callous and brings to light the truth of the saying "It is more blessed to give than to receive." The potency of happiness as an incentive to good will cannot be better illustrated than by this Yuletide spirit. Cheerfulness, however, ought to manifest itself on every occasion and not just at the end of the year. It is just as efficacious in changing the human viewpoint as it is in changing the human aspect. It is the panacea for gloom, and we recommend it to those who woefully shake their heads at the present business depression. Deflation there must be, and chastisement, however grievous, is nevertheless edifying. The application of a little of the Christmas spirit to present conditions would be most salutary. Certainly the future would then appear far from dark.

Commemorating the Electrical Pioneers

IT IS NATURAL that the Oersted-Ampère centennial celebrations we have recently gone through should emphasize the interest in electrical history and the value of its study. History has been defined as a narrative of everything that helps explain present conditions. Its importance lies in handing on great ideas and traditions from one fruitful thinker to another, from one generation of workers to the next. In the present issue one of the former editors of this journal makes an eloquent plea for honoring American electrical pioneers whose centennials loom ahead. He offers four practical suggestions, which have our approval. One is the formation of an American electrical historical society. The second is the publication of electrical history in continuous periodical form. The third is the association with the general national Memorial Day of a special remembrance of our own pioneers and heroes, who lie mostly in forgotten graves while their work lives on for the growing benefit of mankind. A fourth suggestion deals with an obviously more difficult enterprise, the creation of a museum of American pioneer electrical apparatus. Electricity needs its Hall of Fame, in such a shrine of its modest beginnings.

Public Aspects of Interconnection

OPPONENTS of interconnection—and there are some—are losing much time and energy in fighting a well-established economic tendency. Whether interconnection will pay or not in a particular case is an engineering problem, susceptible of pretty accurate solution in advance of the necessary plant and line construction. Attacks upon interconnection as a general program may be made for political reasons or from an honest doubt of the practicability of tying lines together to save money and improve service. Opposition on general grounds, unsupported by evidence, is largely a kicking against the pricks of economic progress. Experience favors greatly increasing this modern electrical operating *entente*. It is incumbent upon the advocates of interconnection, however, to reinforce their widely accepted statements of principle by examples of actual savings accomplished. This has been done to some extent, but a wider publicity is desirable. If a tie-in between a city station and a neighboring hydroelectric property saves 5,000 tons of coal in a year, let the public be so informed. Rate increases may have been smaller because of an advantageous tie-in which has held back a sharp rise in operating costs. Emergency service may have kept things going despite local plant disturbances. Let proper credit be given to the new order of affairs in the local press—it has real news value when "featured" with a big storm, an exceptionally high tide or in connection with an unpreventable failure of equipment.

Careless Thinking on Rural Problem Needs Correction

CARELESS thinking as to the cost of rural-service lines is producing its natural fruit. The letter from G. C. Neff, published on page 1271 of this issue, addressed originally to the *Country Gentleman*, and referring to an article in that periodical, calls attention to one piece of evidence indicating the need of action on the part of the central-station industry. The figures given in the article alluded to indicate that the cost of rural lines is from $500 to $650 a mile. A careful examination, however, shows that this covers only bare material and labor for the line itself, as was clearly pointed out by D. L. Gaskill, president of the Greenville (Ohio) Electric Light & Power Company, in the ELECTRICAL WORLD (Oct. 23, page 838), when the material and labor cost of a typical mile of a 2,300-volt line was shown to be $750. To this must be added the cost of transformers and protective equipment, meters and services, as well as the cost of engineering and superintendence, and last but by no means least the cost of caring for the interference, either physical or electrical, with paralleling telephone lines. The cost of the lines is that required to furnish all equipment necessary for giving service, and regardless of the way in which the expense is divided this total cost must be borne by the service.

The best figures that are available indicate that this total cost per mile varies from $1,200 to $1,500, with a cost per consumer of from $200 to $500. A recent Middle Western investigation gave an average of $480

per consumer. A line which will have three consumers per mile is probably the average, or a little above the average under present conditions, so that the figure from this investigation tallies well with other investigations.

The whole difficulty arises from fear on the part of the central-station industry to face the issue as it has presented itself. This fear has led to the formation of rural utilities and "passing the buck" to the farmers, with a consequent obscuring of the real conditions. The problem is one belonging to the central station, and no amount of dodging will evade the issue eventually, though it may result in an unnecessary expense caused by the formation of utilities that are legally competent but practically incompetent to carry on the business. The solution will not be easy, particularly under present conditions, but it must be found, and the central-station must find it or admit itself beaten at its own game.

The Power Development of the Future

THERE has seldom been a more powerful discussion of this all-important problem than that recently presented by Col. J. P. Jackson before the American Society of Mechanical Engineers. That the future supply of power is of vast importance to the prosperity of the country is self-evident. So far as the manufacturing interests of our nation are concerned, shortage of power certainly means shortage of prosperity, and industries gather where the power supply is plentiful. The actual source of power for a long time was a matter of comparative indifference, and streams were harnessed or coal was transported to meet the requirements of each individual case. Today an entirely different set of conditions must be faced. Transportation has become the dominant factor in industry. We may find fault if we like with what seems and, indeed, is a faulty system of distribution, but we have to face the facts as they are. The result has been that natural water powers well situated with respect to market have been in large measure used up. In fact, few if any of importance remain, so that the country depends on transmitted power either sent over wires in the form of electrical energy or hauled over rails in the potential energy of coal, and coal is undeniably getting scarce.

We should not base estimates of the needless cost and consumption of fuel on present data alone, but must look forward to the inevitable time, not far distant, when the price of coal will rise to an even higher point, throwing a still heavier burden on manufacturer and on railway, and with all this the country is now entering on a period of the most formidable international competition in every industry, to meet the needs of which power should be cheaper rather than dearer. It is for this reason that Colonel Jackson, like all other careful students of economics, turns to transmitted power as the remedy for a condition rapidly growing desperate. In ten years the power plants of the country have grown from an output of nine billion to about forty-six billion kilowatt-hours, and the call for energy is now even louder than it was a decade ago. The remedy is obviously the greatest possible conservation of our natural resources and their development in such wise as to make power supply as nearly as may be universal in distribution and economical in application. To this end it is plain that uneconomical generation of power must be checked, the burden of production thrown on efficient sources, and these so co-ordinated as to take full advantage of the diversity factor, not between city block and city block, but between state and state.

Errors That Meter Records Should Eliminate

METER records constitute the basis of central-station revenue and the final evidence on which controversies as to service rendered are adjusted. It is therefore necessary that any system of meter records should provide the utmost precautions not only against physical loss of the meters themselves but also against inaccuracies in the measurement of the energy used. The latter is the subject portion of the problem, since meter-testing methods have been pretty well standardized and the overhauling of the meters themselves is largely a routine process. In the record system, however, the usual tendencies are to one of two extremes. The first is an elaboration that sometimes becomes so cumbersome as to defeat its own ends and which at the best is expensive. The other is an entire neglect of the record, it being viewed as a necessary evil to be forgotten as far as possible. The description elsewhere in this issue of the system of the Iowa Railway & Light Company outlines a method that experience has shown can provide against loss or mislaying with a minimum of clerical labor.

This system is well worth study, particularly on the part of central-station managers whose service will not support the elaborate meter laboratory arrangements that the larger central stations can maintain and who must depend upon the simpler routine test standards, checked by secondary standards that can be periodically sent to a well-equipped laboratory for calibration. While the larger stations can and must support elaborate meter records, because of the large number of instruments handled, there is no reason why the smaller companies cannot support records that will accomplish the same results. The smaller stations handle a smaller number of meters, have not so many complications to deal with and consequently need fewer safeguards. This fact is too often lost sight of in the working out of meter record systems.

Insufficient Furnace Capacity an Enemy to Economy

IN NO branch of engineering has antiquated convention been so slavishly followed as in rating boilers. The result is that the real conditions of economy are hidden behind a mass of irrelevant data which ought to be brushed aside. It is the particular virtue of the little paper by Theodore Maynz which we published last week that the facts he presents enable one to see through the smoke to something of the real relations between heating surface, efficiency and maintenance. The broad situation is, as Mr. Maynz's diagram shows, that a boiler fitted with an economizer and with plenty of furnace capacity will excel in economy over a wide range of load the more conservative proportions of earlier practice. For central-station working a flat-topped economy curve is all important, for it enables a formidable peak to be carried without losing much in efficiency even when pushing reduced draft. The penalty of too hard driving is increased upkeep even more than loss of efficiency, particularly if the furnace and

stoker dimensions are skimped. With a reasonable number of units in service there is little excuse for operating at under-loads—a practice disastrous to economy.

The boilers themselves will show about the same maintenance cost per unit weight of steam produced within limits of forced output, while with properly proportioned furnace and stoker no excessive maintenance cost will appear. All these facts indicate that, given intelligent care, bad performance of the boiler plant can generally be traced to improper design or operation of the furnace. Insufficient furnace capacity is probably the worst enemy of economy, and this is doubly true when it becomes necessary to operate with inferior fuel. Efficient steam output is the final test of performance.

Getting Away from Antiquity

IT TOOK the automobile designers a good many years to get away from the standard designs for horse-drawn vehicles and evolve something that would make the most of the new propelling power. In the same way it has taken the designers of waterwheels a long time to get away from the idea of treating a low-head hydraulic development along lines of practice which have been based for the most part on fairly high-head conditions.

Happily the old designs have now been abandoned and radical improvements have been taken up in two directions. These, as pointed out by L. E. Ayres in this issue, involve first the redesign of the turbine itself for efficient running at much higher speeds than was once customary, and, second, the treatment of the emerging water column in such way as to give free flow with as little friction and eddy as possible and to regain something of its residual kinetic energy as available pressure. The first end has been met by a radical change in runner construction, by passing from the older design with numerous blades to a four-blade or three-blade type resembling a well-designed ship's propeller more than an old-fashioned waterwheel. The result of recent improvements has been to produce, as is shown in Mr. Ayres' article, runners with four or even three blades comparing quite well in efficiency with the best that has been done with the more conservative constructions. For instance, the actual tests in two typical cases cited show a maximum efficiency of 85 to 87 per cent in three-blade and four-blade runners, going to about 600 hp. under 15-ft. head and at 200 r.p.m. These figures are within 2 or 3 per cent of the performance of standard wheels of similar capacity and head, but of much lower speed, and they are altogether higher than would have been obtained twenty years ago.

Part of the improvement in general results, as already indicated, lies in the more skillful treatment of the outflow. Two analogous but different methods have been used in the plants referred to—one an improved design of draft tube, the other a somewhat more radical treatment of the problem through the introduction of the hydraucone regainer, the construction of which has recently been noted in our columns.

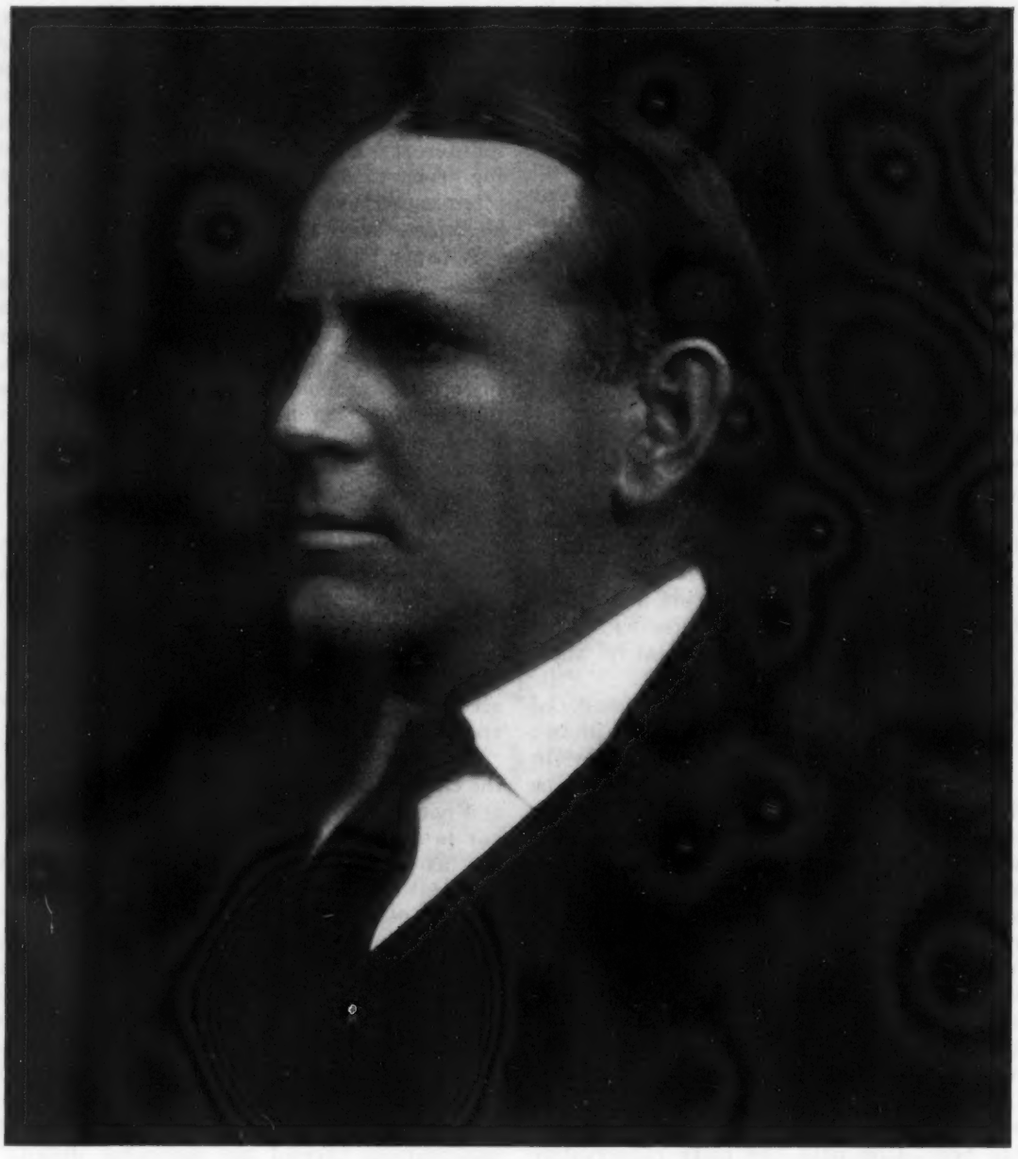
In one instance cited by Mr. Ayres a change from the old to the new type of low-head plant actually increased the hydraulic efficiency nearly 40 per cent and, one may add, undoubtedly decreased attention and repairs in a degree equally conspicuous.

Utilities Entitled to More than Current Investment Earnings

IN ONE way or another the valuation of a utility is used as a working basis for determining rates upon which the actual return to the investor depends. All sorts of hypotheses for equilibrating costs on one theory or the other have been tried out with rather indifferent success. Add to this the complication arising from statutory requirements, which are themselves often vague, and the difficulty of doing the right thing is unpleasantly apparent.

A paper by P. B. Warren in the current issue takes up another phase of the matter in attempting to apply to the question of valuation of public utilities what amounts to a correction factor for the varying value of the dollar. This leads to a value which, although in terms of a somewhat arbitrary unit, takes in a certain measure account of the fluctuations in price on which the cost at any particular epoch may be determined. The fundamental point of doubt in all cases comes from the fact that in a public utility which has been built up perhaps through a quarter of a century there have been many fluctuations in price, and a valuation made on any theory for one particular epoch cannot long remain true. This difficulty confronts one at every turn on whatever theory he proceeds, and Mr. Warren's approximate solution is only one of the ways by which the variation here considered may be taken into account. When it comes to valuing a utility with reference to rate making a wider field of inquiry is open.

One thing is certain, that money put into a plant in the course of its development is entitled to a fair return, and not only to a fair return at the time of investment but to a fair return at the particular epoch for which the information becomes necessary in adjusting rates. It seems to us that what constitutes a fair allowance actually depends on the value of the dollar as expressed, for instance, in current rates of return upon investment. If 8 per cent was a figure considered fair and just as a return when current funds were earning 4 per cent or 5 per cent, a proportionately larger allowance represents a fair return when investments commonly bring 7 or 8 per cent, quite irrespective of what the fluctuations in price may have been in the interim between the two epochs considered. Reconstruction values and modifications thereof are somewhat difficult to apply, because in justice and fairly to represent the conditions of actual construction these reconstruction values ought to be applied with some reference to the times of actual building and the then existing conditions. If all the factors are taken into account, as Mr. Warren points out, the differences in valuation are more apparent than real. It appears to us, however, that actual cost is the most nearly ascertainable basis of real investment, and that the fluctuating value of the dollar so far as it is taken into account, as it should be in ascertaining an equitable return, is more safely based on current investment earnings than on anything else, always admitting that an industry like a public utility is fully warranted in claiming a liberal return on its work as well as on its past investment and that dividends apparently liberal ten years ago do not fairly requite the industry today. By thus applying the correction for fluctuating values to the earning rate permitted from time to time one does not cut loose from the fundamental fact of actual capital invested, while preserving the rights of the stockholders to a fair return even in defiance of a shrinking dollar.



Harold Winthrop Buck

Inventor, engineer, designer, advocate of 13,000-volt generation and pioneer in the development of long-distance hydro-electric transmission

EAGERLY and with a certain sureness do we talk today of 220,000-volt transmission, yet it was only a few years ago that 100,000 volts became an actuality. It was at Niagara Falls, N. Y., about twenty years ago, that H. W. Buck, then electrical engineer for the Niagara Falls Power Company, which at that time was the wonder water-power system of the world, experimented on a 100,000-volt line a mile long. In 1907 he installed a 110,000-volt system for the Great Western Power Company. To perfect a commercial system for such high voltages required considerable research work, particularly on insulators. He became convinced that some other way of insulating high-tension lines than by the upright pin-type method was desirable.

As a result he developed with E. M. Hewlett of the General Electric Company a suspension insulator system for use on some high voltage lines projected by the Niagara Falls Power Company. Mr. Buck was also the first to advocate 13,000-volt generation. Prior to that generator voltages were much lower. In addition he is credited with having designed a three-phase motor operating by static induction.

Mr. Buck was born in New York City May 7, 1873. He received his bachelor's degree from Yale in 1894 and in the following year the degree of electrical engineer from Columbia. The next two years were spent as a student at Schenectady in the General Electric works, after which he went into the lighting department as assistant to the chief engineer.

In 1900 Mr. Buck became electrical engineer for the Niagara Falls Power Company, and seven years later, with M. A. Vielé and F. O. Blackwell, he joined the now well-known organization of consulting engineers—Vielé, Blackwell & Buck.

In addition to high-tension work Mr. Buck has always taken a large interest in hydro-electric development. While at Niagara Falls he had charge of the designs and installation of all the electrical equipment of plant No. 2 and of the Canadian Niagara Power project. Furthermore, his own organization from its inception has specialized on hydro-electric projects.

His counsel is much sought in engineering societies, which he has frequently served on important committees. He is a past-president of the American Institute of Electrical Engineers and at the present time he is the representative of that body on the American Engineering Council.

The Justice of Current-Cost Valuations

Although Original Cost Will Give Same Figure, Provided that Proper Relative Weight in Purchasing Power Is Given to Dollar, Still the Dollar Now Current Is the One Which the Utility Pays Out for Supplies and Receives for Energy

By PHILIP BARTON WARREN
Member of the Illinois Bar

DETERMINING the proper method of utility valuation is of the gravest importance to the continued development of the country's resources. Until the basis of return for money invested in utility property is convincingly and firmly established new money will not flow into this industry. The value of property used in furnishing service is the basis of just and reasonable rates. Because of the importance of this factor much attention has been centered thereon for the purpose of evolving plausible theories that as the interest of the parties dictate will increase or diminish the value. There are advocates of original cost, cost to reproduce at average prices for various periods, cost to reproduce at so-called normal prices, cost to reproduce at trend prices, cost to reproduce at present prices, and the theorists have not yet stopped working. But the truth as to value cannot be altered. Every appraisal, honestly made, on each one of these various theories will reproduce substantially the same value. The difference is only apparent, not real.

Measuring of Results

All will agree that the investors in a utility are entitled to a "fair return upon the reasonable value of the property at the time it is being used for the public." As it is value that is being sought, the meaning of value must first be understood. Value itself is not a vague, indefinite or uncertain characteristic. No one has been able to improve on John Stuart Mill's definition that "the value of a thing is its general power of purchasing, . . . the command which its possession gives over purchasable commodities in general." Clearly, the value of any economic quantity always has been, and always will be, any other economic quantity for which it can be exchanged. In the complexity of affairs it is impracticable to exchange a kilowatt-hour for a certain quantity of bread or nails. This difficulty was overcome many centuries ago by the adoption of a medium of exchange called money. The function of money is that of facilitating exchanges of commodities, and to function it must afford a ready means of estimating the comparative value of the different commodities. Therefore that into which the value of all commodities must be translated for expression and intelligent understanding is money of present purchase power. Value can neither be expressed nor intelligently understood by any other means. Every person who hazards an opinion as to the value of an economic quantity expresses it in current dollars, and no commission ever made a finding as to value that was not expressed in the kind of dollars that were current at the time of expression.

The sole object of a rate proceeding is to ascertain what are just and reasonable rates for utility service at the present and in the immediate future, not at the time of the original construction of the property or as constituting an average during any five-year or ten-year period. The tribunal is endeavoring to ascertain what amount of income, expressed in the kind of dollars current today, will constitute a fair return for the service rendered when paid in rates today and in the immediate future. It cannot ignore the actual conditions existing today, because it is under these conditions the service is to be rendered. Nor can it ignore the kind of dollars that are current today because it is only with that kind of dollars that the customer can pay for the service.

In honest endeavors to determine the value of a property in rate proceedings, widely varying conclusions can almost always be traced to a failure to use the present medium of exchange as a method of expressing value. Money is an economic commodity just as certainly as wheat or coal. Fluctuation in the purchase power of the medium of exchange has always existed and cannot be ignored when expressing value. It is axiomatic that "the value of money is inversely as general prices—falling as they rise and rising as they fall." The result is that when we speak of a dollar in 1910 we are not speaking of the same measure of value as when we refer to a dollar in 1920.

In 1910 a dollar would purchase so much wheat, so much coal or so many hours of labor, and in 1920 it takes two dollars, generally speaking, to purchase the same quantity and quality of wheat, of coal, or of labor. In other words, it takes two of the 1920 dollars to equal one of the 1910 dollars. Therefore, before we can measure the relative probative force of two appraisals of the same property, expressed in dollars current at different periods, we must know what the relative purchase power of the dollar was in the respective periods. If not identical, then proper allowance should be made for the difference. If this is done, no difference will be found in honest valuations of the same property.

The Current Dollar

This problem of the kind of dollar to be used is not difficult of solution. The object of a rate proceeding is to determine what, under the conditions existing at this time, the consumer shall in fairness give to the owner of the utility in exchange for the service rendered. There is to be an exchange of commodities and fairness demands they shall be of equal value. If electric light and power rates are being determined, the commodity offered by the owner is energy and that offered by the consumer is money.

The kind of dollar that is to be exchanged for the energy is the kind of dollar that is current today. The value of the energy is made up of the use of the value of the property by which it is produced and the value of the labor and material consumed in producing it. We are trying to translate these values into a thing that will be comparable with the dollar which is to be paid for them. The only way it can be accomplished is by translating them into the very kind of a dollar the consumer is going to use when he pays for them.

The energy is offered for exchange today. We are

endeavoring to ascertain the power of that energy to purchase other commodities today. We can only measure its purchase power today in terms of the kind of dollar in use today. It may be that the energy and all of the property creating it have no more intrinsic value today than they had ten years ago, but the dollar of today has less intrinsic value, and those are the kind of dollars that must be accepted in exchange for the energy. Every fair mind will recognize that the dollar of today is worth no more in appraising the property than it is when paying the lighting bill. When a commission expresses its opinion of the value of a property in dollars, as the basis of rates to be paid in dollars, the dollars used in both expressions should be the same kind of dollars.

Exchange Value

What determines a thing's value is what it is in its existing conditions and relations—its present actual exchange value. The phrase "exchange value" is not here used in the sense of being the profits of an enterprise capitalized at a given rate of return. That is one measure of an unregulated competitive business. But the moment an enterprise becomes subject to regulation as to its profits—and those profits must be just and reasonable—obviously the existing profits cannot be made a factor in determining just and reasonable profits. The phrase is here used in the sense of being the aggregate costs of energy and material necessary to reproduce the entire property.

The argument advanced against exchange value is that the property is not for sale, that there is no intention to sell it, and therefore that there should not be placed upon it a value based upon demand and supply. True, the property itself is not for sale, but the use of the property is for sale, and every piece of material, from the smallest nail to the largest engine in the plant, and every bit of labor used in its construction and operation, can be acquired by the utility on no other basis than that of exchange value. With no way of altering this fact, how can it be said that the aggregate of the exchange values of all the component parts does not constitute the total value of the physical property? So long as the utility must part with its money upon the exchange value basis for the component parts, is the public entitled to the use of the whole upon any other basis?

Investment in Property

If it were possible for the public to pay the owner for the use of its property in the same kind of dollars that were current at the time of original construction it would not be unfair to accept the original cost as present value. It must not be forgotten that the owner's investment is not the dollars it parted with to acquire the property, but its investment is the property that it thus acquired. True, at that time the property was the equivalent of those dollars, but the owner parted with those dollars and kept the property. It serves no purpose to ascertain the number of dollars it parted with unless we intend to value those dollars. That can only be done by comparing their purchase power with the dollars of today. But why attempt to put a value on the thing the owner parted with when we can more readily put a value on the thing it retained and is now using to produce the service, that is, the property?

The only argument which has ever been seriously advanced in favor of adopting what is called original cost is that stability is thereby given to rates. The fallacy of this is that rates constitute the compensation to be paid by the public for the use of the property. If that compensation is to be measured by a fair return upon the value of the property used, then the relative value of the medium, in which the compensation is to be paid, to the property used, should be known. The rates to be paid are the values to be received by the owner of the property for its use. The value contained in the rates, when expressed by the medium of exchange, is unstable, variable and regulated by the inexorable laws of supply and demand. The customer is no more entitled to stability in rates, when expressed in the medium of exchange, than he is entitled to stability in the price of any commodity—or than the owner of the utility is entitled to stability in the purchasing power of the medium of exchange in which the customer pays for service. The service and use of utility property can only be furnished the customer by means of labor and material, and so long as the cost of labor and material depends upon supply and demand it will be unstable and the charge for the product—*i.e.*, the utility service—must likewise be unstable. The medium of exchange in which the customer pays the owner for the service will likewise be unstable. It would be unjust to make one stable while the others remain unstable.

Effect of Regulation on Return

No one will deny that at the present time the purchase power of the dollar has decreased and there are those who admit that for additions and extensions made today the owner is entitled to a valuation at present-day prices, thus giving effect to the decreased dollar; but they claim it is unfair to measure the value of property acquired some years ago by the present medium of exchange because it would be giving the owners of utility securities an advantage which is not given to the owners of farm mortgages and other securities. This contention ignores the fundamental distinction which exists between those investing in regulated securities and those who invest in unregulated securities. The investor in a farm mortgage or government bond makes a contract that he shall have for a definite period a certain return for the use of his money. No regulatory body can at any time thereafter say he shall not have that return because it is unjust or unreasonable. The man who invests in public utility securities knows that at any time the public utilities commission may investigate and cut his return down if the rates producing it are not just and reasonable. He also knows that no matter what his contract may be he will be permitted to have only a fair rate of return.

It is not absolutely essential that appraisals based on original cost, or average costs during some selected period of time, should be disregarded. The courts have said they are "matters for consideration" and that they are to be given "such weight as may be just and right in each case." But if they are "considered," then in weighing them to ascertain their probative force for the purpose of ascertaining present value the same scales must be used. They are evidence of present value, but before their true weight can be ascertained they must be translated into the terms by which present value is to be expressed; this is, the kind of dollars current today. When they are so translated they will express the same quantum of value as an appraisal based on the cost to reproduce at present prices and will serve as a check.

Certainly one expects to find more accuracy in an

appraisal expressed in dollars of the present day than in one expressed in dollars of some other period. It is much easier for the appraiser to ascertain accurately the present prices of labor and material than it is those that prevailed years ago. It is much easier to test the knowledge of the appraiser as to the latter than as to the former. It is much easier for an appraiser deliberately to deceive the commission as to prices which prevailed many years ago or the average prices of some other period. Furthermore, if appraisals expressed in dollars of some other period must be translated into the dollars of this period before they will express present value, there is always the chance of errors and inaccuracies in making the translation.

The iteration and reiteration of the present tense by every authority on the subject, when speaking of the time as of which the value must be ascertained, shows a deep conviction that value must be translated into and expressed in the kind of dollars current at "the time the property is being used for the public." It recognizes that conditions change from time to time and that it is only fair to fix the value at the time and under the conditions which exist when the service is rendered. It recognizes the fluctuation in the purchase power of the medium of exchange with which the service is to be paid, and thereby provides that the effect of the fluctuation shall at all times bear equally on the owner and public.

The basis of the reasoning is that at all times—abnormal, subnormal or war times—the patron is entitled to a reasonable rate and the owner is entitled to a fair return; that a fair return is a certain percentage of the value of the property—*i.e.*, a definite ratio between the value of the property and the value of the return; that this ratio is not maintained unless the same measure of value is used in determining the return as in determining the property.

If in the future general prices fall and valuations are made on the then prevailing prices, the owner will lose nothing, for the simple reason that the increased purchasing power of the dollar (caused by the fallen prices) in which the return is to be paid will exactly compensate for the decrease in the number of dollars produced by the decreased rate, and the owner will be receiving the same quantity of value for the service he has rendered as he was accustomed to receive during the period of high prices.

THE *true test of success in business is not profits but economy. Profits may be the result of good fortune, of a fleeting period of inflation, of temporary conditions of any kind, but a business structure which is built simply upon the profit sheet of the moment is built upon the sands. The only business foundations which are sure and steady are erected upon the rock of economy. The great need of the world today is to work hard and save. This applies not alone to the laboring man but to the man of great means. There is no place in America today for the loafer. The laboring man is entitled to his full share for the contribution he makes to the value of an article. The laboring man should be taken into the fullest confidence of his employers. He should be so sure of getting his fair share of the wealth he produces that he will work with zeal and enthusiasm. Not merely increased production, but increased efficiency in production, is essential.*—CHARLES M. SCHWAB.

Adapting Signal Indicators to Power Plant Use

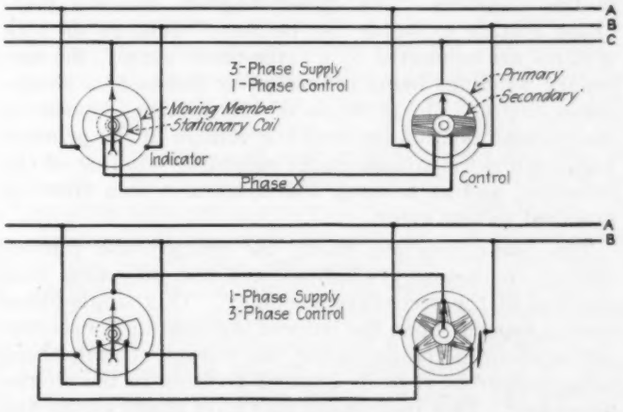
Device Developed for War Use Found Valuable for Plant Purposes—Synchronous Motors Arranged for Transmitting Signals

BY H. P. SPARKES
Engineer Westinghouse Electric & Manufacturing Company

DURING the stress of the war, when development of apparatus for military purposes was so great, not a few devices were perfected of a kind which could later be adopted for commercial use. Manufacturing companies, turning their full energies to helping to bring the war to a successful conclusion, accomplished in many instances a great deal more than might have been possible under peace-time conditions. Furthermore, it is surprising to find to how many commercial uses such devices may be applied. One instance of this is a direction-bearing indicator which was developed for the United States Navy. This apparatus consists of two synchronous motors connected so that when the rotor of one, the transmitter, is placed in a certain position the rotor of the other, the indicator, will be in exact synchronism and will thus indicate the position at which the transmitter is set. On board ship they are used by the mariner in the chart room to inform the pilot as to the proper bearing of the ship. Here they obviate the speaking tube or telephone and allow the information to be conveyed correctly, positively and in a minimum time.

WHEN POINTER IS ROTATED THE DISTANTLY LOCATED INDICATOR FOLLOWS IT

The application of these instruments in the Cheswick station of the Duquesne Light Company, Pittsburgh, Pa., is somewhat similar to their use on ships. The transmitter is placed at the switchboard operator's desk. From the load and weather conditions he estimates the probable power requirements in advance. Then by means of the indicative apparatus he signals the boiler-room that certain requirements will be necessary.



TWO SYSTEMS OF CONNECTIONS ARE USED, DEPENDING ON WHETHER THE PRIMARY WINDING IS CONNECTED TO A POLYPHASE OR SINGLE-PHASE CIRCUIT

The use of these instruments by the Philadelphia Electric Company is also interesting on account of their automatic operation. They are installed on motor-operated induction regulators in such a manner as to indicate the position of the secondary coil at all times. If the regulator secondary is out of phase, the device will indicate the position, and steps may be taken to adjust the phase relation. In other words, the phase relation of the primary coil and secondary coil of the regulator is indicated at all times.

Operates on Principle of Synchronous Motor

The principle of operation of this outfit is the same as that of two synchronous motors, one motor being used as a transformer supplying energy to the second motor from its secondary winding. The second motor, acting as an indicator, receives the energy from the transforming motor into its secondary. At the same time it receives energy into its primary winding from the same source as that from which the primary winding of the transforming motor receives energy. The two primaries of the motors are connected to a polyphase alternating-current system, and, having the same number of poles in the field, they will tend to have magnetic fields operating in synchronism with each other. As the induced current flowing in the secondary winding must become balanced before the motion of each rotor is zero, there will be a tendency of each rotor to move in exact synchronism with the rotor of the opposite motor. According to theory, these two machines will stay in exact synchronism. However, because of friction, there would be some power consumed by the indicating motor when overcoming the initial friction, thus causing an angle of lag. To overcome this error an indicating instrument is utilized which is similar to the switchboard-type power-factor meter. This instrument has practically a zero friction error, and as the movement is exceedingly light and well balanced, it is suitable for rugged service. This allows the use of a motor connected to a power-factor meter or synchroscope in initiate angular relation.

There are two possible systems of connection as shown in the diagrams. The upper diagram shows a polyphase system to which the primary windings of both systems are connected to a three-phase supply, the secondary windings being connected by means of a single-phase circuit. The principle of this system is based on the angular relation between the voltage in the primary winding and the voltage in the secondary winding of the indicator, and as a result this system is free from all practical voltage error.

The lower diagram shows the single-phase connection of the primary windings and the polyphase connections of the secondary windings. This single-phase system depends upon the induced voltages in the secondary winding of the controller, the voltage of each phase being proportional to its angular position in the single-phase field. This instrument may have slight errors due to voltage conditions and inaccurate windings on the controller. On the other hand, the system has the advantage that it requires only a single-phase energy supply.

The normal operating conditions and the insulation of the indicating instrument limit the voltage to 110. However, transformers may be used for long-distance indications. It is preferable to operate this instrument at approximately 100 volts, as above this voltage the installation becomes dangerous, owing to the fact that a breakdown may develop into a grounded system.

The torque characteristics of these instruments depend entirely upon the energy consumed by the indicator, the torque at all points of indication remaining the same. The angular position which the pointer assumes is the position where the flux of the two coils is in phase. If the pointer is distorted from this position, therefore, the torque is proportional to the cosine of the angle.

By calibrating the indicator with the controller with which it is to operate, the maximum and average error can be made very small. This might cause the scale to be slightly distorted, but it is not noticeable on a 7-in. (17.78-cm.) instrument.

These instruments are equipped with dynamic damping disks by means of which the dead-beat characteristics may be adjusted to suit the operating conditions. Such a device was especially necessary to take care of the roll of the ship or periodic vibration.

Effect of Outside Agencies

The use of armored cables with these instruments may cause some trouble on account of the inductance of the armored cables, which sometimes tends to change the power factor of the system. When all leads are of the same length this trouble may be obviated by adjustments.

Little trouble was experienced in the variation of the resistance leads or other resistance inserted into the circuit. The fact that these instruments normally operate with 1,000 ohms per phase, connected in series with the polyphase winding, precludes an appreciable error. This is so because any other resistance inserted in the circuit, such as contact drop or temperature changes causing the copper to change resistance, is comparatively small. However, the cable leads are made the same length if possible. Care must be taken in this system to prevent grounds from occurring. The ground on the circuit may tend to overload or unbalance the system and cause a distortion of the field and in the indicator, thus causing the reading to be incorrect. There is no danger of exterior magnetic fields causing trouble nor of the indicator and controller affecting other devices. Both instruments are surrounded by large iron cores which should prevent any magnetic disturbance. The presence of wireless apparatus or other high-frequency or high-potential systems will not be the cause of any disturbance. Of course, if a high-tension conductor should come in contact with the system, there naturally would be some trouble caused.

It is possible to operate from one to approximately ten indicators from one controller, provided that the rating of the controller will permit this load. If any other controller is connected in such a circuit, it will tend to operate as an indicator having small angular error due to frictional losses. In case one of the windings of one instrument should burn out, which is most improbable, there may be a slight error produced in the other instruments.

Bridgewater Station Turbines

Attention has been called to the fact that the turbines connected to the Allis-Chalmers generators in the Bridgewater station of the Southern Power Company, which plant was described in the ELECTRICAL WORLD for June 5, are I. P. Morris wheels.

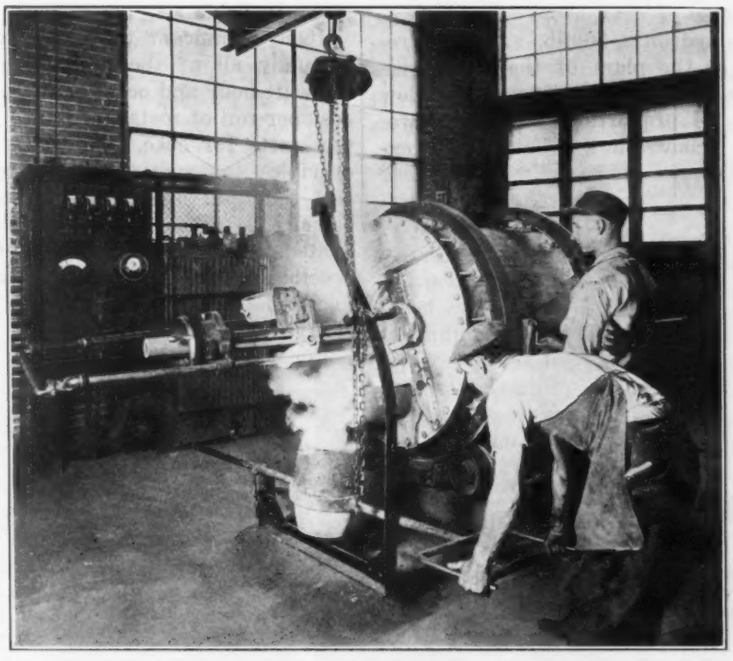
Economies of Melting Brass Electrically

Operating Records Show the High Economy that Has Been Attained by the Utilization of Small Rotating Arc-Type Furnaces in Brass Foundries—Preheating for One Shift Successfully Eliminated

WITH more than 200 brass-furnaces now installed and in successful operation in this country it may be said that electric melting of brass has passed beyond the experimental stage. Many advantages have been claimed for the electric furnace in the melting of non-ferrous metals, and experience has seemed to indicate that in this employment the electric furnace possesses the following characteristics:

(1) Clean, reducing, non-oxidizing atmosphere; (2) superior working conditions—atmosphere not unduly heated and furnace gases reduced to a minimum; (3) ability to obtain any range of temperature, with simple methods of control—using pyrometer if desired; (4) reduction of metal losses to the lowest limits, and (5) low labor and upkeep costs.

The brass foundry needs a small, efficient melting unit to handle the large variety of mixtures comprised in the day's run. Large heats cannot be handled to good advantage for many reasons, but principally because of the difficulty in keeping the metal up to temperature and the long shutdowns between heats. The records presented deal with a rotating arc-type furnace and show conclusively that it is practicable to use a small-type furnace for intermittent daily operation and still obtain low cost records.



AUTOMATIC ELECTRODE CONTROL HAS REDUCED LABOR COST FOR OPERATING THE ROTATING ARC-TYPE FURNACE

Rotation of Furnace Exposes New Metal Surfaces to Hot Lining

In melting yellow-brass turnings and borings, which constitutes one of the most difficult materials to handle in any type of furnace, especially when they are full of dirt, oil and other foreign matter, the furnace should be loaded well up on the walls at either side of the electrodes. The door is then closed, one or both of the electrodes being withdrawn to permit the escape of burning oil and moisture, and the furnace is placed in rotation. As the borings tumble around inside of the furnace new surfaces are constantly exposed to the hot lining, and the oil and dirt are rapidly burned out. In this connection it should be noted that the electric furnace is more valuable as a melting medium than as a drying or oil-burning vessel, and if the constant run of material charged is very heavy with oil it will soon pay, through saving in furnace time alone, to remove the greater portion of the oil before charging. However, if desired, the foreign matter can be easily expelled in the simple manner described before the actual melting begins. As soon as the flame from the burning oil drops off the rotation is stopped, the electrodes are inserted, the power is switched on and the melting started.

The size of the charge will determine when it is practicable to commence complete rotation. If a maximum loading has been made, experience shows that it is desirable to leave the furnace stationary for a brief period and then turn the shell occasionally to mix up the charge, finally allowing complete rotation, which should be continued for ten or fifteen minutes before pouring. This method reduces and sometimes prevents any breakage of electrodes. If a smaller charge has been used rotation can be started immediately. The first method has the advantage that the largest practicable heats can be run, resulting in the maximum daily output. The difference in the metallic shrinkage for the two methods is small.

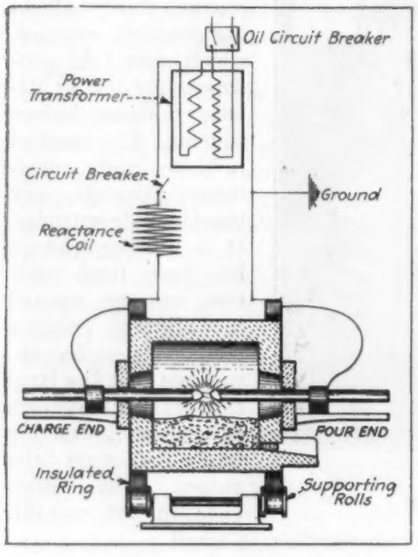
Recent records obtained from the Prime Manufacturing Company, Milwaukee, Wis., on a 500-lb. (230-kg.) rotating electric furnace are given in Table 1. This furnace is used almost exclusively for the melting of yellow-brass turnings and borings, pouring directly into castings. When melting this class of material all live parts of the furnace are carefully cleaned with compressed air after each heat to prevent any short-circuiting by deposits of zinc dust. This requires only a few minutes' time and is generally done between ladles. The movement of the electrodes through the cooling collars is also tested after each heat, and any loose slag is removed from the furnace after each heat is poured.

The melting of other finely divided materials containing less zinc, such as red-brass borings, turnings, skimmings, washings, etc., is comparatively easy to handle, with metallic shrinkage losses averaging not more than 1 per cent and an energy consumption averaging not more than 350 kw.-hr. per ton, even with a small furnace like a 500-lb. (227-kg.) unit, operating only one shift a day and including all energy used for preheating.

With heavier materials, such as heavy scrap, ingots, foundry returns, etc., the practice followed is to hold the furnace stationary after charging until the metal has softened; then partial rotation is started, and finally complete rotation is established.

It has been found possible to eliminate entirely the time usually consumed in preheating the furnace in the morning. Where a foundry has one shift of eight to ten hours a day all that is necessary is fully to charge the furnace at the end of the day after the last heat is poured, ready for the first heat of the following day. Careful measurements with a pyrometer show that when a furnace is left empty over night the temperature of the melting chamber in the morning has dropped to 450 deg. Fahr. (230 deg. C.), but when charged the night previously the temperature of the melting chamber the next morning is up to 900 deg. Fahr. (480 deg. C.). This indicates the possibilities of the furnace in heat absorption and retention.

Records recently obtained on a 500-lb. (227-kg.) rotating electric furnace at the plant of the Enterprise Brass Works, Muskegon, Mich., melting red and yellow brass for castings, in the proportions of about two-thirds red to one-third yellow, show what can be expected when using the furnace on heavy metal. These records follow: Average pounds melted daily, 4,800; average charge per heat, 600 lb.; number of heats per day, nine hours, 8; average power consumption per ton, 310 kw.-hr.



SIMPLICITY IS A BASIC FEATURE OF THE ROTATING FURNACE

A furnace of the same size is in operation at the plant of the Fulton-Harwood Brass Works, South Bend, Ind., and the results obtained are given in Table II. Considering that this furnace was not being charged to its capacity the showing made is considered exceptionally good. It shows what can be done with the furnace even at reduced output. The records given in Table II were from June 9 to July 9, 1920, and the charges consisted of new copper, tin, lead and zinc, with an analysis of 85-5-5-5 per cent. No record was kept of the shrinkage at this plant, but under similar conditions at other plants the metal loss has not averaged more than one-half of one per cent.

The Yale & Towne Manufacturing Company, Stamford, Conn., recently completed thorough tests covering every phase of the operation of a 500-lb. rotating electric furnace. The user in this case requires a high pouring temperature owing to the light-weight castings made, and likewise the time between heats is lengthened since the metal is all drawn into small pots. As a consequence it was necessary to keep the power on the furnace while pouring, which made the power consumption high and slightly increased the metal loss. There were other disadvantages in handling due to the location of the furnace in the foundry, so that when the foundry practice is thoroughly worked out much better records should be made. The analysis of the metal in percentage was: Copper, 86.93; zinc, 9.62; tin, 1.86; lead, 1.38; iron, 0.21. A summary of the test data is given in Table III.

TABLE I—OPERATING RECORD OF 500-LB. ROTATING FURNACE MELTING YELLOW-BRASS TURNINGS

Pounds melted per day—one shift	3,900—5,500
Average daily output, lb.	4,950
Average charge per heat, lb.	550
Number of heats per day	8—10
Number of hours' power on furnace daily	10—11
Average melting time, minutes	40
Time between heats, minutes	15—25
Average power consumption per ton, kw.-hr.	300

Lining (made of good grade of arch fire-clay brick) has lasted approximately 500 heats and is good for many more. Electrode consumption per ton metal under 6 lb. No records as to net metallic shrinkage, exclusive of oil, dirt and moisture, are available, but careful tests made on the same type and analysis of material in other furnaces show that this need not exceed an average of 2 per cent.

It is significant that, even with an energy rate in virtually all of these plants of at least 2 cents per kilowatt-hour and occasionally up to 3 cents, the energy cost per ton of metal melted is no higher than present-day costs for coke, coal, oil and gas. As the use of crucibles for melting is eliminated with this furnace and the total upkeep and repair costs on the 500-lb. furnace do not average more than $2 per ton of metal melted, which is considerably lower than the cost of crucibles alone, the large savings made in metal losses and in labor show a handsome margin in favor of the electric furnace.

For the brass melter who has a large number of mixtures or whose daily output is limited a rotating electric furnace of still smaller holding capacity can be obtained. This is known as the 250-lb. (115-kg.) size. In all details of its construction it is identical with the 500-lb. furnace, and the power input is proportioned so that the same speed of melting results. Figures from a recent day's run on a 250-lb. furnace at the plant of the Hill Pump Valve Company, Chicago, will illustrate this point in Table IV.

TABLE II—RECORD OF 500-LB. ROTATING FURNACE MELTING RED BRASS

Pounds of metal melted	80,000
Kw.-hr. consumed	14,761
Kw.-hr. per ton of metal	370.8
Pounds of metal per kw.-hr.	5.42
Cost of electric energy, per ton	$8.68
Electrode consumption, lb.	147½
Electrode consumption per ton metal, lb.	3.7
Cost of electrodes per ton of metal	$0.925
Number of heats	147
Life of lining in which these heats were melted, heats	520
Cost of lining per heat of metal	$0.3846
Cost of lining per ton of metal	$0.961
Cost of electrical energy, electrodes and lining, per ton of melted metal	$10.566

Leitel Brothers, Chicago, have a 250-lb. furnace which

TABLE III—TESTS OF 500-LB. ROTATING FURNACE ON HIGH TEMPERATURE WORK

Heats	Charge, Lb.	Melt Time, Minutes	Kw.-Hr. to Hold Heat	Total Kw.-Hr. Used	Delay, Minutes	Total Time, Minutes	Metal Poured, Lb.
7	4,060.0	317	69.8	712.4	7	552	*
5	3,045.0	292	60.0	729.8	22	538	3,007.5
4	2,436.0	295	38.0	644.2	50	530	2,391.0
7	4,263.0	363	0.0	783.8	41	608	4,209.5
6	3,654.0	305	13.0	791.2	21	545	3,620.5
5	3,045.0	254	51.0	595.0	38	501	3,010.5
34	20,503.0	1,826	232.6	4,256.4	174	3,274	†16,239.0
Ave. per ton (10.252 tons)		178	22.7	415.2	16.9	319	
Ave. per heat		53.7	6.84	125.0	5.1	96.4	

Average weight of heat, lb.	603
Total working time, hours	54.6
Average time between heats, minutes	37.4
Average metal melted per day, lb.	3,417
Average kw.-hrs. per ton	437.9
Average electrode consumption per ton, lb.	‡6.55
Gross shrinkage, per cent	1.24
Non-metal in charge (approximately), per cent	0.13
Net metal loss, per cent	1.11

* Box of gates missing. † 2.8 lb. Nipples

TABLE IV—A DAY'S RUN ON A 250-LB. FURNACE MELTING RED BRASS

Heat No.	Power On	Power Off	Kw.-Hr. Used	Wt. of Charge, Lb.	Time Between Heats, Min.
1	6:00 a.m.	8:35 a.m.	125	346	25
2	9:00	9:58	50	348	24
3	10:22	11:25	52	351	23
4	11:48	12:50 p.m.	52	340	25
5	1:15 p.m.	2:15	50	362	25
6	2:40	3:40	53	384	27
7	4:07	5:00	48	371	..
Total			438	2,502	...

Average energy consumption, 343 kw.-hr. per ton. No preheating required. From three to five minutes taken to skim through door on each heat. Zinc added at this time. Metal used, old scrap copper (bearing blocks). Pouring time ten to twelve minutes between heats. Remainder of time cleaning electrodes and coolers and charging furnace.

has been in operation for more than a year and a half (see ELECTRICAL WORLD, Dec. 20, 1919, page 1107, for early records). Many of the heats of yellow-brass scrap have shown an energy consumption of 240 kw.-hr. per ton, while on yellow-brass turnings and borings 210 kw.-hr. per ton has not been uncommon. Some of the linings have lasted almost 900 heats and none less than 600 heats. This represents a cost of less than 10 cents per heat, or, conservatively, 75 cents per ton. Accurate weighing of electrodes each day shows only 3½ lb. to 4 lb. (1.6 kg. to 1.8 kg.) consumption, including breakage, per ton of metal. Shrinkage has not averaged more than three-quarters of 1 per cent on red brass, nor more than 1.4 per cent on yellow brass. Heats as small as 100 lb. (45 kg.) have been made showing only a slightly higher average for all items than when the furnace is run to rated capacity. The most efficient basis naturally is to charge a maximum of metal per heat, which for this furnace would be approximately 380 lb. (110 kg.).

The Nordyke & Marmon Company, Indianapolis, Ind., is using one of the 250-lb. furnaces for making its most difficult alloys and castings, including silicon bronze and other special mixtures. A considerable portion of the time the furnace runs for sixteen hours per day. Many heats of red brass have been made at the rate of 270 kw.-hr. per ton, which is generally considered a good record even for a 2,000-lb. (900-kg.) furnace.

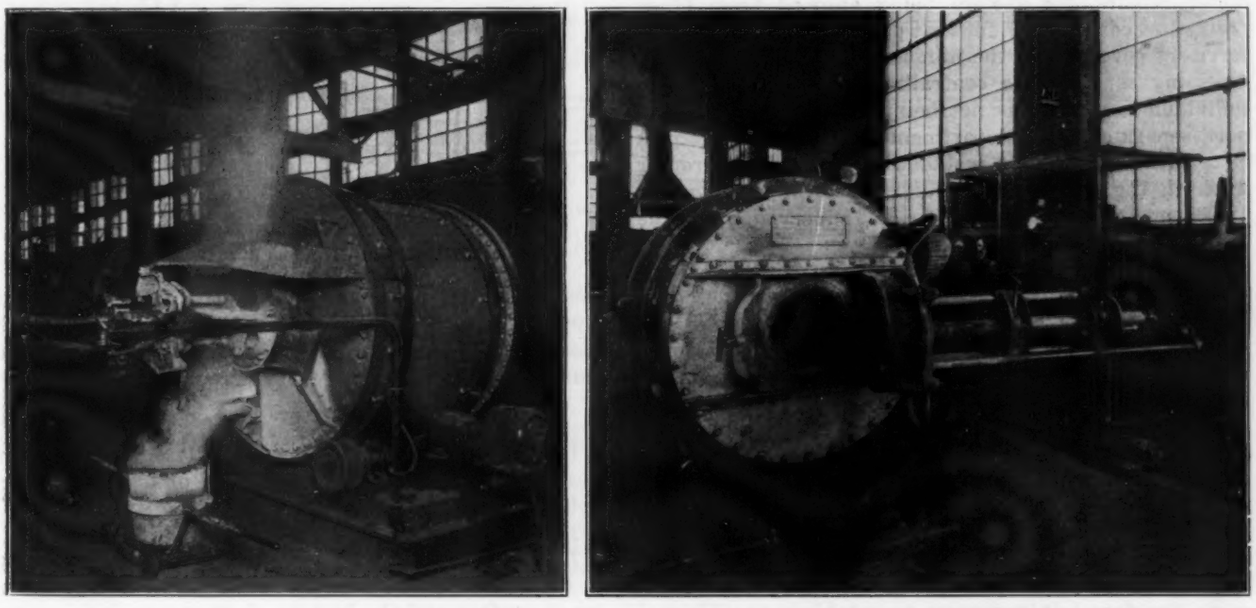
TESTS MADE ON A ONE-SHIFT BASIS

No records are yet available showing what results can be secured when operating the different sizes of rotating furnaces on a twenty-four-hour schedule. The tests herein recorded are all on a one-shift basis averaging ten hours, including all time for preheating.

It will be noted that the number of heats per nine-hour day will average eight on yellow brass and seven on red brass, the charge in each case being about 20 per cent heavier than the rated holding capacity of the furnace. This will work out uniformly for all sizes. It is therefore entirely practicable to make a reasonable estimate from these data as to what this type furnace will do on a twenty-four-hour day schedule, if operated on the same basis of efficiency.

Eliminating from consideration the first heat of the day, and allowing an average of twenty-five minutes between heats, these data indicate that the 250-lb. furnace would have a total daily output of at least 6,000 lb. (2,700 kg.) and an average power consumption of 285 kw.-hr. per ton on red brass and 235 kw.-hr. per ton on yellow brass. With the 500-lb. furnace the output would reach 12,000 lb. (5,400 kg.), and the average power consumption on red brass should be 275 kw.-hr. per ton and that on yellow brass 225 kw.-hr. per ton. The 2,000-lb. furnace should melt a daily output of 48,000 lb. (21,600 kg.) with an average power consumption on red brass of 250 kw.-hr. per ton and on yellow brass of 210 kw.-hr. per ton.

This subject was also discussed before the American Foundrymen's Association by C. H. Booth of the Booth Electric Furnace Company.



EXPERIENCE HAS SHOWN THAT THE ELECTRIC FURNACE OFFERS AN ECONOMICAL SOLUTION FOR THE MELTING PROBLEM OF THE BRASS FOUNDRY

On the left is shown a 2,000-lb. booth furnace at the plant of the Michigan Smelting & Refining Company pouring yellow brass after melting a charge of yellow-brass turnings and borings containing nearly 4 per cent of oil. The ½-hp. motor used for automatically controlling the operation of the electrode may be seen in the middle at the left-hand side of the photo. This motor can be thrown out of gear if hand operation of the electrodes is desired. On the right is shown the electrode-holder construction of a 500-lb. furnace. The furnace is in the shape of a cylindrical drum, which minimizes the radiating surface. The doors are placed at the axis of the shell where the electrodes enter the furnace. The cylindrical walls of the shell are unbroken, thereby permitting complete rotation of the furnace. The electric current is brought onto the furnace by moving-contact method.

Meter Records Can Be Simplified

A Record that Requires a Minimum of Labor, but Is a Thorough Check Against Loss—Shortage of Competent Metermen Makes Training School Necessary—Rules for Guidance of Wiring Contractors Found Necessary

By EDWARD HOWELL and CHARLES L. ROSE
Iowa Railway & Light Company, Cedar Rapids, Iowa

THE meter department headquarters of the Iowa Railway & Light Company is situated at Cedar Rapids, Iowa, and supervises the meter maintenance and repair work of the Iowa Railway & Light Company, Iowa Electric Company and the Iowa Falls Electric Company. The systems cover a large section of central Iowa as shown in Fig. 2. All meters required for the three companies are furnished through the Cedar Rapids meter storeroom, which carries a large stock of repair parts and handles all meter repairs, the meters being shipped from other points to Cedar Rapids for that purpose. Because of the territory covered and the number of small communities receiving service, this centralization is necessary, the individual communities not being large enough to support separate meter departments. The Cedar Rapids office alone handles the installation, removal and repair work in the Cedar Rapids division for approximately 12,000 meters in addition to its supervision of the remainder of the system.

In common with all other companies the Iowa Railway & Light Company experienced extreme difficulty in securing competent men during the war and some of the details of the record system described were dropped after years of successful use and the meter department has not been able as yet to pick them up again. The record system as described originated in Cedar Rapids in 1902 and has the merit of long continued use, during which the usual development difficulties have been thoroughly weeded out.

Training Meter Department Men

Owing to the shortage of competent men the department has found it necessary to establish an informal school in which the men are taught elementary electricity and the meaning of the electric circuit, the aim being to give them a thorough grounding in the fundamentals, after which the proper care of meters, repairing and adjusting are taught. This training is accomplished largely through lectures and blackboard illustrations given once a week.

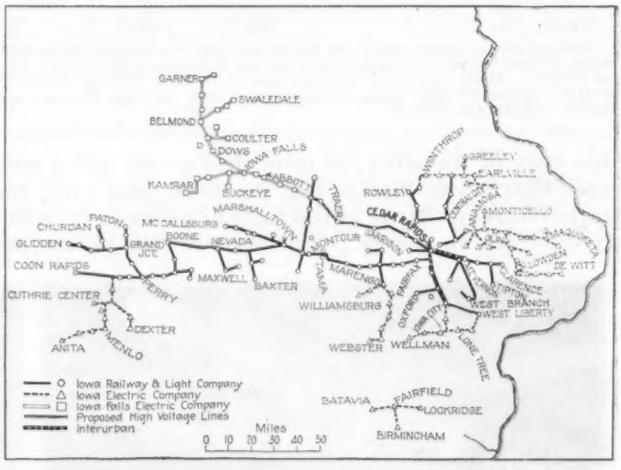


FIG. 2—EIGHTY IOWA CITIES AND TOWNS IN TERRITORY SERVED BY IOWA RAILWAY & LIGHT COMPANY, IOWA ELECTRIC COMPANY AND IOWA FALLS ELECTRIC COMPANY

Actual Working of Meter Records

The meter record consists of: Meter card, meter location card, meter test card, record of tests on meter, meter summary card.

The method of use of these cards is as follows:

The Meter Card (Fig. 3-E) is a permanent property record of the meter giving all of the physical data affecting the meter and the history of its entry on the property, its cost and final removal. These cards are filed in manufacturers' numerical order, the company having found it unnecessary to establish its own numbers.

Date..... Order No.....

Name .....
Address .....
Order .....
Connect .....
Disconnect .....
Remarks .....

Probable Load .....

Form C308-10M-4-20

Date.....19..... Order No.....

Name .....
Address .....
Clearance No. ..... Work Order No. ..... Date Issued .....
Class ..... Credit .....
Connected to Transformer at .....

METERS	SUPPLY RECORD		LOAD RECORD		
	No.	Ledger	No.	Kind	Capacity
	Reading	Meter Loc.			
	Make	Meter Sum.			
	Voltage	Cons. Rec.			
	Size	Cons. Sum.			
	Kind	Load Rec.			
	Constant				
	CONNECT				
	DISCONNECT				

Remarks .....

Approved ..... Signed .....

FIG. 1—ORDER FORM FROM WHICH ENTRIES SHOWING INSTALLATION AND REMOVAL OF METERS ARE MADE
Only three cards are handled and entries made after the cards are originally filled out. These are the location cards, the record of tests on meter and meter summary

The Meter Location Card (Fig. 3-D) contains the name plate data of the meter and space for installation, and removal data as the meter is handled in the process of meter operation. These are filed by manufacturers' serial number.

The Meter Test Card as shown in Fig. 3-F is a record of each individual test made on any meter and is filed by manufacturers' serial number.

Record of Tests on Meter—This is a record of the series of routine tests on any given meter and is filed by dates of the last test shown in the entries. See Fig. 3-C. The purpose of the card is shown under the remarks on testing.

The Meter Summary Card shown in Figs. 3-A and 3-B is designed to show the number of meters both by sizes and total in service, in the storeroom and owned, at any given time. In handling, when new meters are received, the proper entries are made under the storeroom and total heads in black ink. When meters are transferred from the stores to service the proper entries are made under the meters in service in black ink and under storeroom in red ink. In carrying over from card to card, each card must be balanced between the totals on the back and the sum of the totals in service and in stores, while at the end of the calendar month an inventory by serial numbers of the meters in the storeroom is taken. The location cards are separated in the file between those in service and in storeroom. Location cards shown in the storeroom are checked against the inventory, which shows at once if any errors have been made. When meters are scrapped the proper red ink entries are made under storeroom and total heads. This method gives the nearest to an infallible check on the loss of meters that it has been possible to devise.

These are all 3 by 5 in. (7.6 by 12.7 cm.) cards excepting the last named, which is 6 by 9 in. (15 by 23 cm.).

Source of Entries for Meter Cards

In the above no mention has been made of the source of entries on the meter location card and summary. As orders for connection or disconnection are received the form shown in Fig. 1 is filled out by the order clerk as to name and address and sent to the line and meter departments for execution. The order comes to the meter department when the line department has completed its work and the meter department fills in the meter and load data. Each day before the completed orders are turned in to the accounting department the meter location and summary cards are entered, thus insuring the keeping up of the meter record day by day. When the orders are made out at the order desk they are numbered serially, the stub being retained by the order clerk as his record and a check against any possible loss of the form in routine handling.

All meters are tested as received from the factory and as they come into the meter storeroom during the course of routine operation. It has been the plan to test meters

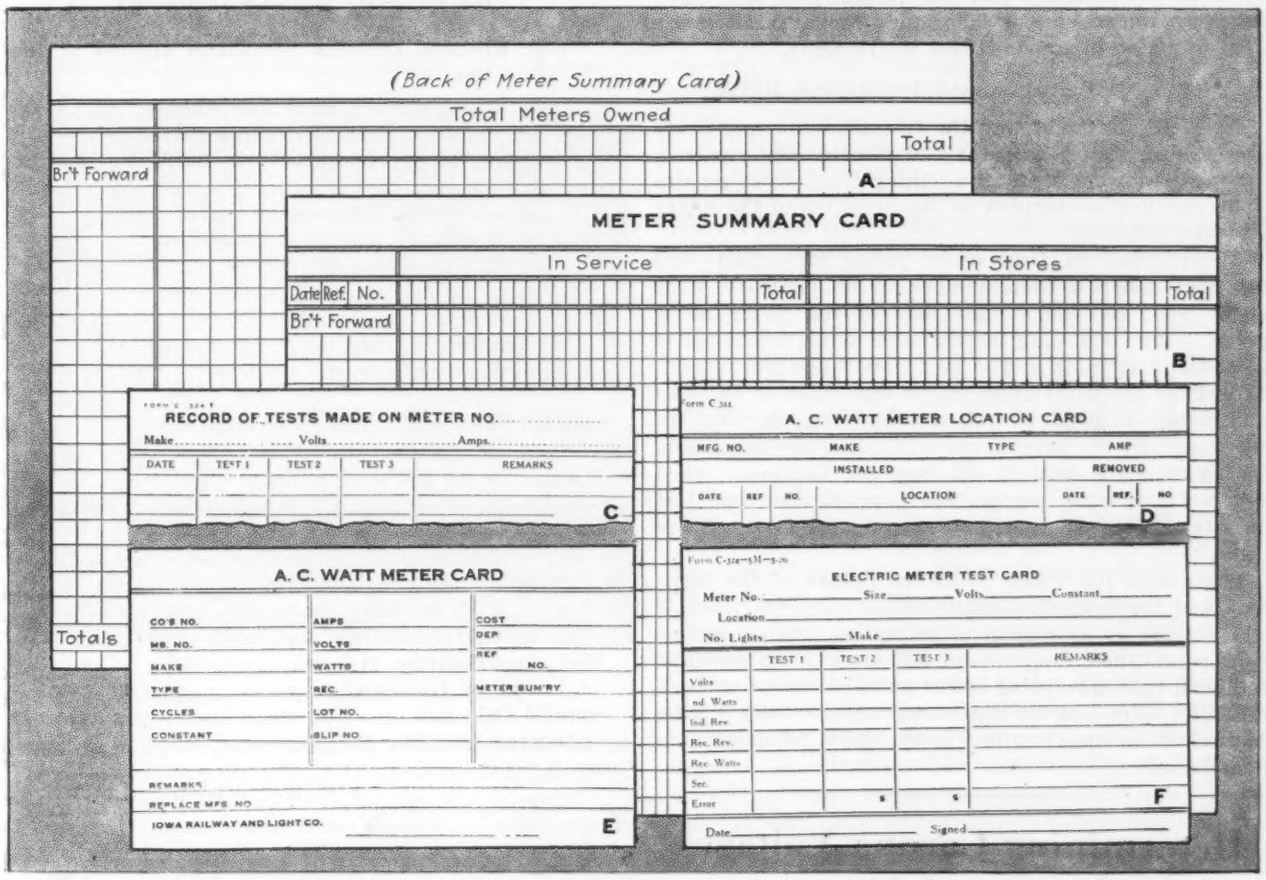


FIG. 3—COMPREHENSIVE METER RECORDS THAT CAN BE MAINTAINED WITH A MINIMUM OF WORK

A and B. Meter summary card.
C. Record of all tests on any given meter.
D. Location card recording travels of the meter in routine operation.
E. Permanent record of meter.
F. Record of individual tests.

in service periodically, but the program has been somewhat upset by lack of competent men. Routes were laid out originally and tests made which are recorded on the forms shown in Figs. 3-F and 3-C. Fig. 3-C was then filed in date order. As the testing is a continuous process the result is a test file in the order in which tests have actually been made that the testing force follows as a guide. The installation of new meters or recently tested meters on a route introduces a slight complication which is handled either by advancing the date on the test card to correspond with the date on which the route is tested or handling the new meters as pickups along with the meters that are missed for one reason or another in the routine testing. It has not been found necessary to provide primary standards to control test standards, but a set of secondary standard instruments sent when necessary to an outside laboratory for calibration are used to maintain standard test instruments.

RULES FOR REPAIRING AND INSTALLING METERS

All meters brought into the storeroom for any cause are cleaned, tested, adjusted and if necessary repaired, the repairing consisting of anything from slight repairs to overhauling as complete as the condition of the meter indicates necessary.

Meters received from other points for repairs are recorded under a shop number in an ordinary stock blank book, the name plate date of the meter being given. The test data before and after repairing is recorded, also the material and time taken for repairs, as well as the point from which the meter is received and finally shipped to. A shipping tag showing the shop number, the point from which it was shipped and the name plate data is attached to the meter when received and when repairs are complete the final test data is also recorded on this tag preparatory to reshipment.

Because of the widely scattered nature of the territory and the numerous small towns, rural territory in which there is no municipal inspection service and no rules established, the company has found it necessary to establish rules governing meter installations. Copies of the rules were sent by registered mail to every wiring contractor in the territory and strict compliance is insisted on.

Determining Corona Voltages for Actual Lines

Tables for Transmission Line Corona Voltages Agree Well with Equations Set Up—Some Expedients for Avoiding Abnormal Losses

BY F. W. PEEK, JR.
Consulting Engineer General Electric Company

IN ORDER to complete the discussion of transmission line practice in America, as outlined by the writer in ELECTRICAL WORLD of Nov. 27 and Dec. 4, it is essential that some discussion of corona voltages for high-tension lines should be added to give data on this important characteristic as determined by several years of study and also by tests of transmission lines in this country.

On the higher-voltage lines it is necessary to take certain precautions, otherwise the air insulation immediately surrounding the conductors will be broken down or corona will appear, with the accompanying loss.

The laws of corona have been quite definitely worked out and are as follows:

(1) Disruptive critical voltage:

$$e_o = g_o m_o r \delta \log_e (S/r) \text{ kv. to neutral}$$

(2) Visual critical voltage:

$$e_v = m_v g_v r \log_e (s/r) \text{ kv. to neutral,}$$

where

$$g_v = g_o \delta \left(1 + \frac{0.30}{\sqrt{\delta r}}\right) \text{ kv./cm.}$$

$$\delta = \frac{3.92\, b}{273 + t}$$

(3) Power loss:

$$p = (241/\delta)(f + 25)\sqrt{(r/s)}\,(e - e)^2 10^{-5} \text{ kw.}$$

per kilometer of single conductor,

where

e = effective kilovolts to neutral applied to the line
= ½ kv. between lines single-phase; $1/\sqrt{3}$ kv. between lines for three-phase.
δ = air density factor = 1 at 25 deg. C. and 76 cm. barometer.
b = barometric pressure in centimeters.
g_o = disrupture critical gradient
= 21.1 kv./cm.
g_v = visual critical gradient kv./cm.
t = temperature, deg. C.
r = radius of conductor in centimeters.
s = distance between conductor centers in centimeters.
f = frequency, cycles per second.

Irregularity factors:

m_o = 1 for polished wires
= 0.98 — 0.93 for roughened or weathered wires
= 0.87 — 0.83 for seven-strand cables.
m_v = m_o for polished wires = 1.
m_v = 0.72 for local corona all along cable.
m_v = 0.82 for decided corona all along cable.

For approximating storm loss consider

e_o = 0.8 of fair weather value in equation (3).

Special Calculations.—For small conductors the loss is calculated from the following equation:

$$p = (241/\delta)(f + 25)\sqrt{\frac{r + (6/s) + 0.04}{s}}\,(e - e_d)^2\, 10^{-5}$$

kw. per kilometer of single conductor.

$$g_d = g_o \delta \left(1 + \frac{0.30}{\sqrt{\delta r}} \frac{1}{1 + 230\, r^2}\right).$$

$$e_d = g_d r \log_e (s/r).$$

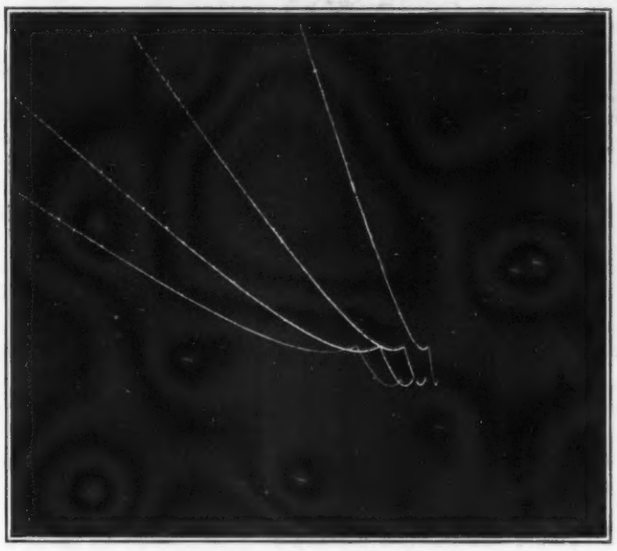
The *visual critical voltage*, e_v, is the voltage at which the wires begin to glow.

For clean wires there should be no loss until the voltage e_v is reached, when the loss should suddenly assume a definite value and increase as the square of the difference between the applied voltage and the *disruptive critical voltage*. The visual critical voltage takes into account the apparent strength, which is a function of the wire diameter; the disruptive critical voltage corresponds to the constant strength of air for uniform fields, which is 21.1 kv./cm. The visual critical voltage is always higher than the disruptive critical voltage. Owing to irregularities there is always a loss below the visual critical voltage. This loss follows the

probability curve. On transmission lines, however, the quadratic law (3) is generally closely approximated even on this section of the curve.

Safe and Economical Voltages.—It will generally be found that it is safe and economical to operate a line up to but not above the fair weather e_o voltage at summer temperature. This will give loss during storms. During cold weather, however, the critical voltage will be higher and the storm loss less. Beside the loss of energy, corona may be undesirable from the standpoint of harmonics.

Arrangement of Conductors.—In the above formulas it has been assumed for three-phase lines that the conductors are arranged in an equilateral triangle. When conductors are not so placed, but in a plane, corona will start at a lower voltage on the center conductor than on the outside conductors. The actual critical voltage on the center conductor will be approx-



CORONA AT 230 KV. (1.19-CM. DIAMETER [0.47-IN] CABLE—310 CM. [10-FT.] SPACING)

imately 4 per cent lower and on the outside conductors 6 per cent higher than for an equilateral triangle of the same spacing.

Various means have been used for increasing the size of the conductor. For equal conductivity an aluminum conductor has about a 25 per cent greater diameter than a copper conductor and, therefore, approximately 25 per cent higher critical voltage. The advantage of aluminum may be still further increased by the addition of a steel cable core. Such a cable has been used for several years on a 154-kv. to 165-kv. line in California. A copper tube or a copper conductor with a suitable core may be used. Several conductors of the same potential may be arranged close together.

Agreement of Calculated and Measured Losses on Actual Transmission Lines.—In most cases when losses have been measured on transmission lines the check is in close agreement with the calculated values. The agreement is, in fact, within the limit of error of the measurements on commercial lines. Apparent discrepancies have generally been due to the fact that the measurements are often made at voltages below the visual critical voltage where the loss depends upon irregularities as discussed above. The loss between e_v and e_o closely follows the quadratic law for large conductors,

TABLE I—CORONA LIMIT OF VOLTAGE—STRANDED CABLES
(Kilovolts between lines, three-phase, sea level, 25 deg. C.)

Size, B. & S. or Circ. Mils	Diameter, In	Diameter, Cm.	Spacings, Cm. and Ft. 91 3	122 4	152 5	183 6	245 8	305 10	366 12	426 14	490 16	610 20
4	0.230	0.584	..	56	58	60	62	64	66	68	69	71
3	0.261	0.663	..	62	65	67	70	72	74	76	77	80
2	0.290	0.736	..	..	71	73	76	79	81	83	85	87
1	0.330	0.839	..	..	79	81	85	88	91	93	95	97
0	0.374	0.950	..	..	..	90	95	98	102	104	108	109
00	0.420	1.07	..	..	..	98	104	108	111	114	117	121
000	0.470	1.19	..	..	..	..	114	118	121	124	127	132
0000	0.530	1.35	..	..	..	..	125	130	135	138	141	146
250,000	0.590	1.50	..	..	..	..	138	144	149	152	156	161
300,000	0.620	1.57	..	..	..	..	..	151	156	161	165	171
350,000	0.679	1.73	..	..	..	..	..	161	166	170	175	180
400,000	0.728	1.85	..	..	..	..	..	171	176	180	185	192
450,000	0.770	1.96	..	..	..	..	..	178	184	190	194	200
500,000	0.818	2.04	..	..	..	..	..	188	194	199	205	210
800,000	1.034	2.62	..	..	..	..	..	..	234	241	244	256
1,000,000	1.152	2.92	..	..	..	..	..	..	256	264	270	281

but for new conductors, and especially for small conductors at high altitudes when the difference between e_o and e_v is quite large, the loss will generally fall below the quadratic curve.

Corona Limit on High-Voltage Transmission Lines.—The accompanying tables give the corona limit of voltage for various conductors at various spacings. A

TABLE II—CORONA LIMIT OF VOLTAGE—WIRES
(Kilovolts between lines, three-phase, sea level, 25 deg. C.)

Size, B & S. or Circ. Mils	Diameter In.	Diameter, Cm.	Spacings—Cm. and Ft. 91 3	122 4	152 5	183 6	245 8	305 10	366 12	426 14	490 16	610 20
4	0.204	0.524	51	54	56	58	60	62	64	65	66	68
3	0.229	0.581	..	59	62	64	66	68	70	72	74	76
2	0.258	0.655	..	..	69	70	74	76	78	80	82	84
1	0.289	0.734	..	..	75	77	81	83	86	88	90	92
0	0.325	0.826	..	..	..	85	89	92	95	97	99	102
00	0.365	0.928	..	..	..	94	98	102	105	107	110	113
000	0.410	1.04	..	..	..	..	109	113	116	119	121	124
0000	0.460	1.17	..	..	..	..	120	125	128	131	134	138

table is also given for altitude correction. It will be noted it does not require a conductor of unreasonable size to transmit at 250 kv. or even higher.

The values in the above tables correspond to the disruptive critical voltages at 25 deg. and 76 barometer and give an approximate idea of the voltage limit imposed by corona. For single-phase or two-phase

TABLE III—ALTITUDE CORRECTION FACTOR AT 25 DEG. C.

Altitude Feet	Altitude Meters	δ	Altitude Feet	Altitude Meters	δ
0	0	1.00	5,000	1,530	0.82
500	152	0.98	6,000	1,835	0.79
1,000	305	0.96	7,000	2,140	0.77
1,500	459	0.94	8'000	2,450	0.74
2,000	611	0.92	9,000	2,750	0.71
2,500	765	0.91	10,000	3,050	0.68
3,000	918	0.89	12,000	3,670	0.68
4,000	1,220	0.86	14,000	4,290	0.53

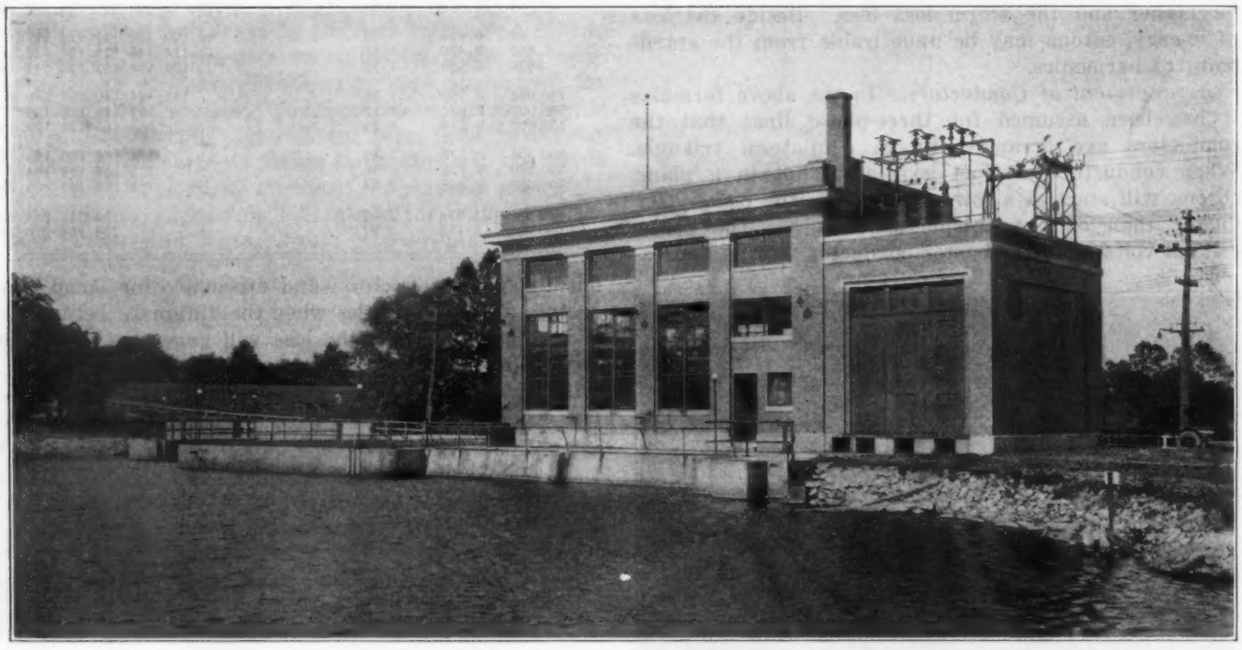
multiply the three-phase values by 1.16. To find the value at any altitude multiply the voltage found above by the corresponding δ.

REASSURANCE *of this principle [private property] came at a time when not only our people but the world had need of it. I hold that no more dangerous attack can be made upon liberty than by the adoption of a general policy of government ownership. By it the government would finally own the people.*—VICE-PRESIDENT-ELECT CALVIN COOLIDGE.

Developing the Low-Head Plant

Rehabilitation of Old Plants by Installing Hydraucones with High-Speed Runner—Gain in Efficiency Should Be at Least 25 per Cent—Comparison of Hydraucone with Stream Line Draft Tube

By LOUIS E. AYRES
Principal Assistant Engineer to Gardner S. Williams, Consulting Engineer, Ann Arbor, Mich.



LOW-HEAD PLANTS SUCH AS THE GEDDES PLANT OF THE DETROIT EDISON COMPANY ARE BECOMING MORE ATTRACTIVE FINANCIALLY SINCE IMPROVEMENTS IN DESIGN HAVE TAKEN PLACE

IN ANY attempt to utilize more completely the low-head water powers of this country, of which so many are to be found throughout the North Central States, the engineer is confronted with two types of problems—first, those involved in the reconstruction of old, inadequate and badly deteriorated mills and electric generating stations, and, second, those arising out of the design of new water-power plants to operate under heads as low as 8 ft. to 10 ft. (2.4 m. to 3 m.). It frequently happens that such reconstruction projects and low-head developments may not, on preliminary inspection, appear attractive financially. The most efficient design and most economical construction may often be necessary in order to turn the scales in favor of a particular undertaking. Any suggestions, therefore, leading to increased efficiency and more economical construction would seem to be in order.

Old plants, in general, may be placed in one of two groups—first, those which are virtually used up and worn out and must be abandoned or completely rebuilt; second, those which are structurally in a fair or good state of preservation and can be repaired and utilized for many years, but which contain obsolete, ill-fitted or worn-out hydraulic machinery.

Some old paper mills and hydro-electric generating stations in Michigan, Minnesota, Wisconsin, Illinois and adjoining states which were built thirty to forty years ago fall into the first group. The old timber flumes are now rotted and leak badly; the turbine-gate mechanisms are so worn that they no longer effectively shut off the water and other means must be employed to stop the turbines; bearings are continually settling and require constant "shimming" to keep them in line, and in some instances the building sills and superstructure are in such a state of dilapidation as to be a constant source of danger to the lives of the operators. Ordinarily nothing can be done with these old plants except to rebuild them completely. Frequently there is no salvage unless it be the scrap value of the machinery.

But there are also many old mills of a more substantial type of construction whose walls were built of stone, or of concrete after the advent of Portland cement as a common building material. The effective rehabilitation of such old plants may be accomplished with comparative ease. The old structures can for the most part be utilized, and the task of rebuilding consists mainly in replacing the hydraulic equipment by modern turbines designed for the existing head and speed, of adequate capacity and properly installed.

Although one finds instances where turbines are operating above their proper speeds and with efficiencies lower than 50 per cent, as a rule it may be said that economic speeds are roughly approximated. Turbine efficiencies have, however, been increased about 10 per cent during the last twenty-five years. If no further improvement could be effected in a particular plant than to replace old by new turbines, an increase in efficiency of at least 10 per cent is to be anticipated from such a change. As great an opportunity, or even a greater one, for bettering the efficiency lies, however, in an improved setting. It may be conservatively

stated that where an increase of efficiency of 10 per cent is possible by replacing old by new turbines, at least an additional 15 per cent may be expected from a well-designed, modern setting.

TYPICAL EXAMPLE OF HOW PLANT EFFICIENCY MAY BE INCREASED

As an example of what may be accomplished in a modern mill, the Watab Pulp & Paper Company of Sartell, Minn., in 1916 replaced its hydraulic equipment by more efficient, modern turbines in improved settings. The original plant was built in 1908 and was therefore only eight years old at the time of its hydraulic reconstruction. The magnitude of the undertaking was considerable, involving as it did the replacement of fifty-one runners in twelve main units. The result of the change was to increase the hydraulic efficiency about 40 per cent, the plant machinery capacity 100 per cent, and the annual output of water-ground pulp more than 50 per cent. It was estimated by the management that the increased revenue resulting from the changes would be sufficient to cover the cost of the improvement in about two years.

In two hydraulic power plants recently completed in Michigan* there are incorporated new features in design which are marked departures from past practice and have an important bearing on the problems involved in both the rebuilding of old and the development of new water powers under relatively low heads. The plants referred to and herein described are that of the Cheboygan Electric Light & Power Company, on the Black River, near Cheboygan, Mich., and the Geddes plant of the Detroit Edison Company, on the Huron River, just outside of Detroit.

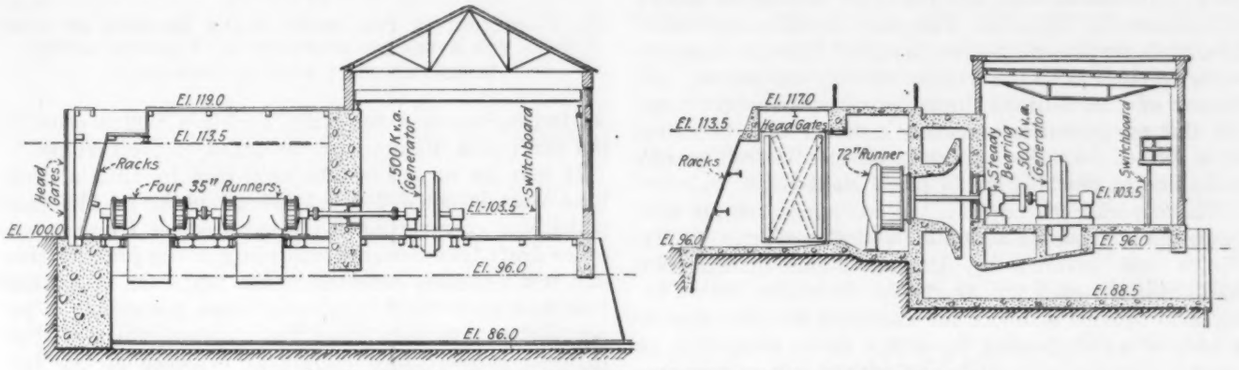


FIG. 1—COMPARISON OF THE OLD-TYPE LOW-HEAD PLANT WITH THE NEW

On the left is shown a section through old hydro-electric plant of the Cheboygan Electric Light & Power Company, Cheboygan, Mich. On the right is a section through new hydro-electric plant of the Cheboygan Electric Light & Power Company, showing compactness as compared with the old installation. The over-all distance from bulkhead to upstream bearing was reduced by half.

REDUCTION OF FLOOR SPACE IS SHOWN IN THE CHEBOYGAN PLANT

In Fig. 1 is shown a cross-section of the old station of the Cheboygan Electric Light & Power Company of Cheboygan, Mich., compared with a cross-section of the new station. The old station was equipped with horizontal quadruplex units similar to many installed during the last quarter of a century. In the new plant a single runner replaced four runners, driving the old generators at the original speed. The over-all distance from the inside face of the bulkhead wall to the farthest upstream bearing is less than half as great in the new plant as it was in the old. This shortening of the driving shaft and reduction of the number of bearings from four to two results in a simpler, cheaper and more compact design.

Incidentally it may be noted that the flume walls of the new plant have been carried upstream of the turbine a sufficient distance to allow the installation of head-gates of the swinging "barn-door" type. Such gates have proved a practical success in several plants. They enable the penstocks to be readily drained for turbine inspection and as quickly filled, and they appear to be less expensive than any other gate that has been satisfactorily employed for such purpose.

The new Cheboygan plant is the first application of the hydraucone with high-speed runner to a horizontal setting. The design allowed the utilization of the old generators, and the saving effected thereby together with that resulting from the shorter flume and a single turbine instead of a quadruplex unit made it possible to build this plant at a very reasonable cost. The power house complete, including about 600 ft. (183 m.) of head and tailrace rendered necessary in order to keep the old plant in operation during construction, cost less than $45 per horsepower of installed capacity. In view of the fact that the average cost of low-head water-power developments in Michigan at pre-war prices may be placed at approximately $150 per horsepower of machinery capacity, including both power house and dam, the Cheboygan plant without the dam may be considered at least an average investment.

ADAPTABILITY OF PRESENT DESIGNS TO REBUILDING OF OLD PLANTS

The chief interest in this design arises from its applicability to the rebuilding of old horizontal electric plants and paper mills where the structures are substantial and well preserved.

Fig. 2 illustrates the application of the Cheboygan design to a mill typical in cross-section of many now in operation in this country. The flume originally contained a quadruplex unit which pretty well filled the space available. The old concrete is shown single-hatched and the new concrete with the usual symbol. The changes include lowering the old floor and building a 3-ft. (0.9-m.) concrete bulkhead across the old penstock to act as a back to the sheet-steel hydraucone. The center line of the shaft remains as before. The amount of concrete to be removed and replaced per penstock is quite immaterial in view of the change effected. If

*Designed by Gardner S. Williams, consulting engineer, Ann Arbor, Mich.

by such a transformation of the hydraulic end of a paper mill an increase of efficiency of 20 to 30 per cent can be consummated it would be obviously very well worth while.

Fig. 2 shows clearly the saving that might have been effected originally had a present-day high-speed runner then been available, as there is a waste space of over 20 ft. (6.1 m.) upstream of the new turbine. In such instances this waste space may well be utilized by installing swinging headgates similar to those shown in the Cheboygan plant (Fig. 1), as such gates are measurably superior to the ordinary sliding type.

COMPARISON OF THE HYDRAUCONE WITH THE STREAM-LINE DRAFT TUBE

In Fig. 3 appears a cross-section through the Geddes plant of the Detroit Edison Company showing in solid lines the hydraucone of unit No. 1 and in dotted lines the outline of the stream-line draft tube of unit No. 2. This plant is also unique in that it contains side by side the best present-day conception of two types of turbine settings. The hydraucone is the design of William M. White, manager and chief engineer of the hydraulic department of the Allis-Chalmers Manufacturing Company, Milwaukee, Wis., and the draft tube is the design of Gardner S. Williams. The plant contains two Allis-Chalmers vertical high-speed units of 500-kva. capacity each, together with the usual accessory equipment. Although of liberal inside dimensions, the structure housing this equipment is unusually compact and attractive. It is located 30 miles (48 km.) west of Detroit on the main line of the Michigan Central Railroad.

The "hydraucone regainer" is an "apparatus for utilizing the hydraucone action of water" perfected by Mr. White and covered by United States patent No. 1,223,843, issued April 24, 1917. This invention "designs to provide a device for changing the direction of a body of water flowing through a closed conduit in as short a distance as possible and with regain of pressure from velocity by utilizing the hydraucone action of water in power-plant construction where the cost and difficulty in excavation beneath the power house for the draft tube are important factors." By the "hydraucone

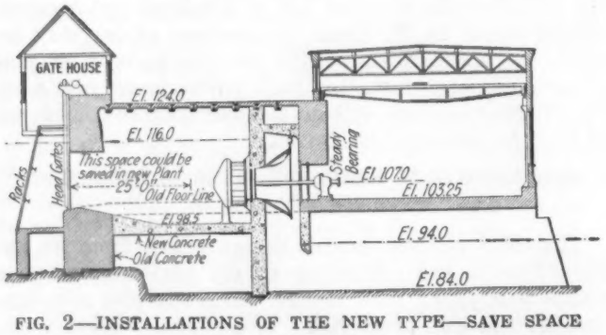


FIG. 2—INSTALLATIONS OF THE NEW TYPE—SAVE SPACE

Application of Cheboygan design to a typica' mill installation, showing the space that could be saved in a new plant with the improved design with resultant economy in cost of construction.

action of water" is meant "that action which occurs as the stream impinges against a surface and is deflected therealong." By experiment the shape of the frustoconoid formed when a free circular jet impinges against a plane surface has been carefully determined and the proportions applied to the construction of the outlet conduit below the turbine.

The draft tube below unit No. 2 is the result of a considerable amount of experimentation to determine the most efficient form. Heretofore good draft-tube design has been an attempt to apply experimental knowledge of the action of water flowing past a 90-deg. bend in a pipe. The tube in the Geddes plant, however, is designed on the theory that the column of discharging water may be treated as though it were a portion of a

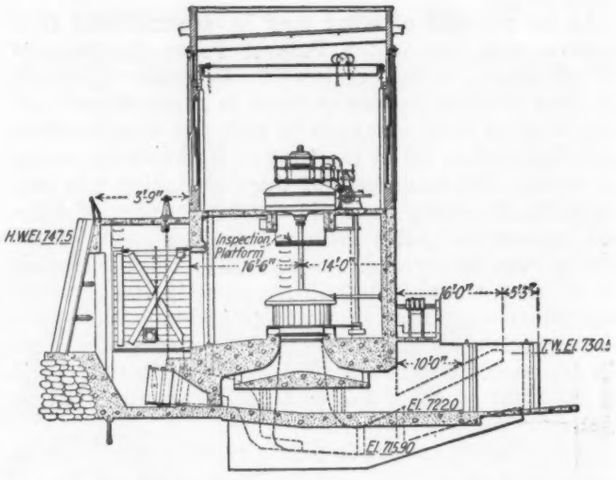


FIG. 3—SECTION OF THE GEDDES PLANT SHOWING IN SOLID LINES THE HYDRAUCONE OF UNIT NO. 1 AND IN DOTTED LINES THE DRAFT TUBE OF UNIT NO. 2

jet impinging on a flat plate, having a radius equal to the draft-tube diameter at the outlet of the turbine.

It may be of interest to note that in 1915 a draft tube was designed for a low-head plant in Michigan which was constructed in the same power house as another draft tube designed according to the practice then and still generally accepted as the best. On actual test this tube gave about 7 per cent more power and 5 per cent better efficiency than the standard form.† This incident is mentioned merely as evidence of the fact that the design of the outlet conduits to a turbine may affect efficiency to a much greater extent than is generally supposed.

Experiments on a model of this first Williams draft tube, made in connection with the development of the "hydraucone," showed the hydraucone to give an efficiency at least as high. It will therefore appear that inasmuch as the Geddes draft tube, as shown by the test curves in Fig. 4, is for the higher gates about 2 per cent more efficient than the hydraucone, the improvement in draft-tube design from the standard type to the hydraucone is about 5 per cent and to the Geddes stream-line design nearly 7 per cent. In comparing the two designs it is to be remembered that the draft tube requires the deeper and the hydraucone the wider setting.

HIGH-SPEED RUNNERS OF THE NAGLER TYPE ARE USED

The runners installed in both the Geddes and the Cheboygan plant are of a new type designed in 1916 by Forrest Nagler and now being manufactured by the Allis-Chalmers Manufacturing Company. In appearance the Nagler runner resembles an ordinary ship's propeller and is built with either three or four blades. There are now in operation at the Geddes plant a three-blade runner discharging into a hydraucone and a four-blade runner discharging into a draft tube, both

†See *Transactions A. S. C. E.*, Vol. 78, page 1572.

set vertically, and at the plant in Cheboygan County two four-blade runners, set horizontally, discharging into hydraucones. The four-blade runner is of cast steel, rated at 600 hp. at 15-ft. (4.6-m.) head and 200 r.p.m.

The history of the development of these runners and their hydraulic characteristics are quite completely set

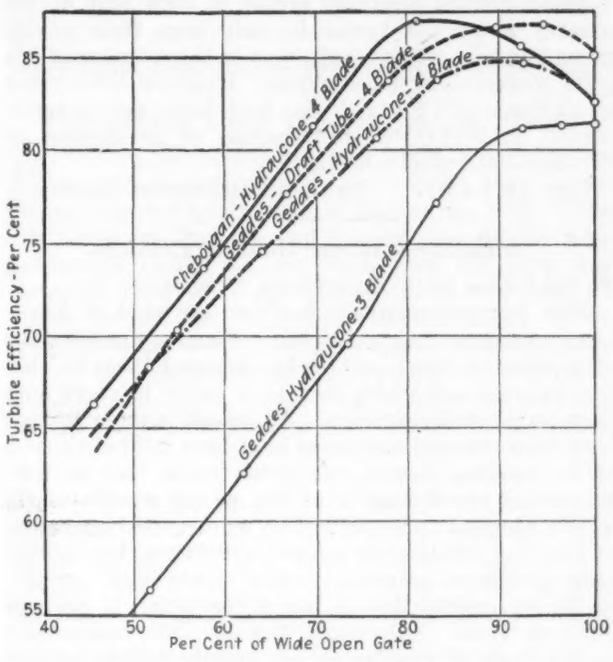


FIG. 4—EFFICIENCY CURVES OF THE GEDDES AND CHEBOYGAN TURBINES

forth in a paper presented by Mr. Nagler before the American Society of Mechanical Engineers in December, 1919. The reader is also referred to an article on "High-Speed Wheels for Low-Head Plants," by A. Streiff, printed in the ELECTRICAL WORLD for July 17, 1920.

OVER-ALL EFFICIENCY AS HIGH WITH HIGH-SPEED WHEELS AS WITH STANDARD TYPE

Complete efficiency tests were made of the Geddes plant in 1918 and of the Cheboygan plant in 1920. At Geddes two four-blade runners, one set over the draft tube and the other over the hydraucone, were first tested. This gave opportunity for comparison of settings. Later the four-blade runner was removed from the hydraucone setting and replaced with a three-blade runner, thus affording comparison of runners under identical conditions. The units were tested at all gates and over the entire speed range from zero, or blocked wheels, to runaway speeds. Heads were observed in accordance with accepted practice and the wheel discharge was measured at Geddes over a sharp-edged weir in the tailrace and at Cheboygan by current meters near the flume entrance.

In Fig. 4 are presented the efficiency curves determined by the tests. The maximum efficiency appears to be about 87 per cent in the case of the four-blade runner in the horizontal hydraucone setting at Cheboygan. The same runner in the vertical setting at Geddes closely approximates the Cheboygan efficiencies, with its best efficiency on the stream-line draft tube about 86.7 per cent, and on the hydraucone slightly less than 85 per cent, in both the latter settings the maximum coming at a higher gate opening than at Cheboygan.

The three-blade runner is for the highest gates about 1 per cent and at lower gates within its working range 5 per cent less efficient than the four-blade runner. The advantage of the three-blade runner, however, lies in its greater capacity, which is a characteristic of some importance during high water.

The important point to be emphasized with reference to these tests is that for the first time in experience with low-head developments it has been possible to obtain efficiencies on horizontal-shaft units equal to or better than those obtained in vertical installations and better than those obtained at Holyoke.

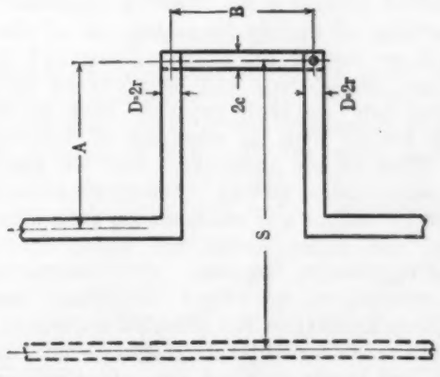
Contrary to notions thus far accepted, the efficiency of the high-speed runner appears to be within 2½ per cent of that of the best standard-type runners for similar capacities and heads, and this deficiency is usually made up by the increased efficiency of the generator due to higher speeds.

Magnetic Forces in Disconnecting Switches

A FORMULA for the calculation of the forces acting on disconnecting switches as published in the ELECTRICAL WORLD for July 10, page 63, contained errors, not in the original, which are corrected below. The paper of H. B. Dwight from which the formula was abstracted said that the calculation of the forces acting on disconnecting switches is useful to switch designers and also to designers of electric circuits who desire to know what form of circuit will produce the least strain on the switch. The results of an analysis of this problem were discussed in the two following equations:

The total force at the break jaw when A is greater than B (see figure) is:

$$\frac{I^2}{4.45 \times 10^7}\left[2.30 \log_{10}\left(\frac{B}{r}\right) + \frac{1}{3} - \frac{B}{A} + \frac{1}{4}\frac{B^2}{A^2} + \frac{3}{20}\frac{r^2}{A^2} - \frac{1}{32}\frac{B^4}{A^4} + \frac{B}{S}\right] lb.$$



LAYOUT TO EXPLAIN MAGNETIC FORCES ACTING ON A DISCONNECTING SWITCH

When A is less than B, the force is:

$$\frac{I^2}{4.45 \times 10^7}\left[2.30 \log_{10}\left(\frac{2A}{r}\right) - \frac{2}{3} - \frac{1}{2}\frac{A}{B} - \frac{1}{6}\frac{C^2}{A^2} + \frac{3}{20}\frac{r^2}{A^2} + \frac{1}{24}\frac{A^3}{B^3} + \frac{1}{24}\frac{AC^2}{B^3} + \frac{B}{S}\right] lb.$$

where I is in amperes. If the circuit does not return behind the switch, the term $\frac{B}{S}$ is zero.

Readers' Views and Comments

Honoring the American Electrical Pioneers

To the Editor of the ELECTRICAL WORLD:

SIR: Your issue of Dec. 11 contained a most interesting suggestion from a correspondent to the effect that the recent Oersted-Ampère celebrations might well lead to a revival of interest in electrical biography and history. My own association with this subject, whether as an editor for twenty-eight years of this journal or in other capacities, is perhaps well enough known to justify me in seeking to give a very emphatic approval to the remark of "W. C. F." that "The human element which interests men so strongly in geographical discovery and exploration is present, too, in the new worlds first revealed by devoted and intrepid scientists and has too long suffered neglect." And I would venture to quote from my own appreciation of Thomas Davenport, the forgotten builder of electric motors in 1834-35, at the unveiling of his memorial at Brandon, Vt., in 1910: "A nation that spends as much every year for electricity as for daily bread may well entertain sentiments of reverence for its pioneers in the electrical arts."

We electrical engineers have indeed ourselves been neglectful of our forerunners; but you hardly ever find Pilgrim Fathers putting up monuments to themselves, and electricity is still in its foundational, constructive stages. It is always a sign of a more advanced civilization to be appreciative of its creators and find time for reverential recognition. The continuing desire for knowledge of human leaders and what they have done is attested by the fact that "The Outline of History" by H. G. Wells is distinctively the "best seller" of 1920.

The writing of its history is but one of the obligations that we owe to the electrical past and to future generations whose lives will be governed by it. At no distant date we shall probably have an electrical historical society with its magazine of *memoires pour servir*. That is one necessity. But we also need a museum of electrical history. Today the relics of early American inventions and mechanisms, even when poorly preserved and authenticated, are widely scattered in the most distressing fashion. Our commercial companies, spurred on by patent litigations, have done more to save them than the technical societies; but the factory museums are literal morgues—not centers of education and inspiration. A few collections are found in the colleges, and the National Museum in Washington has made a feeble effort to do justice to the numerous electrical arts. It all needs co-ordination as the result perhaps of some great endowment.

Meantime, perhaps the suggestion may be offered that while writing their histories and collecting with filial care their pathetic little pieces of crude apparatus we might now and then honor the graves of these men. There should be an electrical decoration day, part of the national celebration, for those who often gave more than their lives to create the arts and industries by which we live. Who knows where the great American electricians lie, excepting Franklin? Who can lead us to the resting places of Henry, Morse, Davenport, Farmer, Wallace, Van Depoele, Phelps, Rowland and others whose deeds can never sink into the twilight of oblivion?

Might not the electrical groups in each part of the country where our heroes lie help keep their graves green and bear witness each year to the splendor of the gifts conferred by these pioneer American electricians on all mankind? So far is this from being merely sentimental, it might well be regarded as an element in further electrical development.

New York City. THOMAS COMMERFORD MARTIN.

A Business Where Honesty Prevails

To the Editor of the ELECTRICAL WORLD:

SIR: For generations it has been the wont of Americans to asperse their politicians. Charges against them of robbing the public which has honored them by election to office and which they have sworn to serve have been distressingly common. All too often these charges have been substantiated or at least have not been shown to be slanders, though one would think that no self-respecting representative of the people would remain quiet a moment under accusation of dishonesty, whether of the kind constituting a legal crime or of the subtler, safer and more prevalent variety where legal accountability is avoided though moral dereliction is perhaps quite as great. Politicians, however, like worms and barrel hoops, if trodden on too heavily, will turn; and now comes Senator Lenroot of Wisconsin with the following declaration:

"Disregard for law, contempt for legal obligation, seems to have struck the business world with blighting force. I have been engaged in politics for more than twenty years. I used to say that we should demand the same standards of honesty in politics that business men demand in business. I cannot say that any more. Indeed, I could today almost plead with business men to have the same standards of honesty in business that politicians have in politics."

If Senator Lenroot's indictment be true—and its substantial truth so far as some industries in some parts of the country are concerned is only too apparent—the electric light and power companies have good reason to felicitate themselves that they at least are not besmirched. Perhaps this recommendation sounds like emulation of the pharisee of old, but the temptation is strong.

Honestly captained and honestly capitalized, submitting willingly to the governmental regulation that their character as public utilities invites, they stand out as encouraging examples of a fact too often doubted—that great executive ability can be attracted and developed without the incentive of profits which are fabulously large.

The breakdown of the building trades under the weight of a rampant and greedy individualism, on the one hand, and the failure of the national government, on the other, to conduct successfully and free from thieves the business of transportation by land and by sea, throw into cheerful prominence the great electric light and power industry that has led all other public utilities along the middle path of sagacity and rightly founded progress. FRANK W. CHASE.

Brooklyn, N. Y.

Station and Operating Practice

A Department Devoted to Problems of Installation, Operation and Maintenance of Equipment for Economical Generation and Distribution of Electrical Energy

Pulverized Coal Versus Stoker Firing

BURNING pulverized fuel was found to be more economical, under certain conditions, than stoker firing, in recent trials made in Milwaukee, Wis. These conditions are that the coal has not over 12,000 B.t.u. per pound (1,370 cal. per kg.), that the plant load factor is not over 70 per cent, that the coal costs not under $4 per ton and that the developed boiler-horsepower amounts to at least 3,000. Pulverized coal firing is of particular advantage in plants operating under a widely varying load, under loads of low factor and when the quality of the coal used varies widely.

STOKER AND PULVERIZED FUEL GROSS EFFICIENCY FOR EQUAL NET RESULTS

	Pulverized Plant	Stoker
Coal preparation	$0.30	$0.00
Firing, ash disposal and maintenance	0.12	0.25
Increased fixed charges	0.06	0.00
Total	$0.48	$0.25
Cost per ton fired, 12,000 B.t.u. coal	$6.48	$6.25
Gross boiler efficiency, per cent	80.67	78.00
Net boiler efficiency, per cent	74.85	74.85

The output of a pulverized-coal-fired boiler which has been idle twelve hours can be changed in ten minutes to 100 per cent output and can be dropped back to zero in a few minutes without blowing the safety valve.

The only no-load loss is radiation, which is negligible compared with the cost of banking stoker-fired boilers. The saving during the period of banking increases with the cost of coal.

The saving due to the use of powdered coal increases as the calorific value of the coal decreases, because the gross boiler efficiency with this kind of fuel is practically independent of the quality or heating value of the coal, while with stoker operation the boiler efficiency decreases with the heating value of the coal. This allows for the fact that the cost of preparation is greater with poorer grades of coal.

Recent improvements at the Oneida Street plant of the Milwaukee Electric Railway & Light Company indicate that the cost of coal preparation in a plant developing about 20,000 boiler-hp. at 70 per cent load factor and burning 700 tons (630 metric tons) per day would be 25 cents per ton for $4 coal, and 30 cents per ton with coal at $6 per ton. Using the figures for the 12,000 B.t.u. coal at $6 per ton, a comparison is made in the accompanying tabulation of stoker and pulverized coal firing. This shows that to equal the efficiency of pulverized coal a stoker would have to develop a gross efficiency of 78 per cent, which is rarely obtained in the best stoker operation with such coal. With coal cheaper than $4 per ton the advantage is with the stoker.

Present best practice in firing powdered coal allows between 12 per cent and 13 per cent CO_2. When this is exceeded the furnace temperature rises proportionately, destroying the furnace brickwork, and a hard-ash slag difficult to remove is formed on the bottom of the furnace. The combustible in the ash averages less than 7 per cent. Automatic firing can be carried on to a further extent with pulverized fuel than is possible with stoker firing. The furnace volume required with powdered coal is about 2.5 cu.ft. (0.071 cu.m.) per developed boiler-horsepower. The boiler and furnace maintenance cost at Milwaukee has been low. No trouble has been encountered from ash or slag adhering to the bottom tubes.

S. N. CLARK.

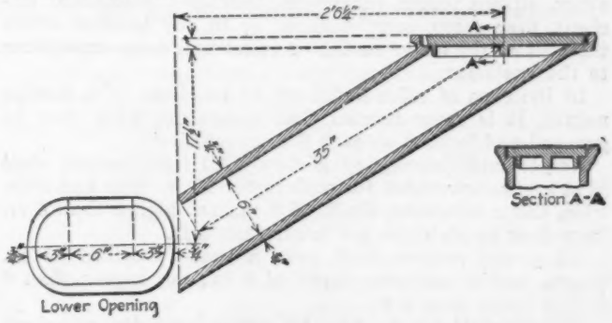
Chicago, Ill.

Melting Current of Aluminum and Copper Wires Compared

TO COMPARE the melting points of copper and aluminum wires of about the same resistance per foot a test was made recently in which No. 4 steel-reinforced aluminum wire was placed in series with No. 6 stranded copper wire and 1,000 amp. was allowed to flow through the circuit. The copper wire melted in four seconds. Using the same steel and aluminum wire, the burned copper wire was replaced by a new one. When the current was again turned on the aluminum wire failed in four and one-half seconds. This test was mentioned by M. E. Noyes, Aluminum Company of America, at a section meeting of the American Institute of Electrical Engineers.

Handhole Assists in Pulling Underground Cable

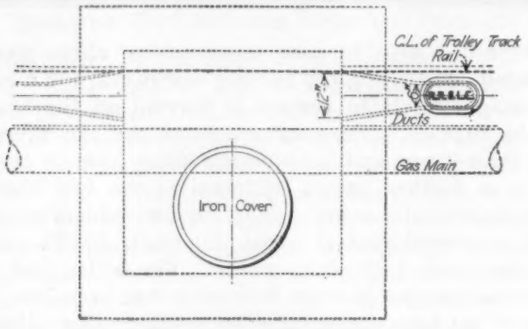
A SPECIAL handhole for the entrance of cable was fitted on manholes of the Rochester (N. Y.) Gas & Electric Company where it was impossible to place the manhole opening in line with the cable ducts. The duct runs almost directly below a street-car rail, while just outside the rail and parallel to it runs a gas main. As neither track nor main could be disturbed, the opening to the manhole had to be placed outside the pipe. With an opening so far out of line with the duct it is



SPECIAL HANDHOLE USED FOR PULLING CABLE

very difficult to install or remove cable. Therefore the special handhole was installed near the track directly over the duct.

This handhole is made up of a casting in the form of a funnel with the large end opening into the manhole wall over the duct line and the small end cut at an angle so as to be flush with the street surface and closed with a cast-iron cover. The inside shape and



HANDHOLE PLACED IN LINE WITH DUCT TO FACILITATE PULLING CABLE

size are such that a cable can easily be fed in either direction. A number of these handholes have been made and have proved a great help to the underground department.

HENRY A. DAVIS.
Rochester Gas & Electric Company,
Rochester, N. Y.

Rules for Installation of Meters and Motor Equipment

DIRECTIONS to be followed by contractors who install meters, motors and their wiring have been drawn up by the Iowa Railway & Light Company, Cedar Rapids. These rules cover meter loop wiring and the location and protection of meters and motors. The rules are as follows:

Location of Meters.—All meters hereafter installed on customers' premises shall be located either in the cellar or on first floor and as near as possible to the service, in a clean, dry, safe place and on a support free from vibration. Where it is necessary to install meters out of doors, they shall be protected from the weather.

In no case shall meters be installed in coal or wood bins or on partitions forming such bins, nor on any unstable partitions or supports. Meters should not be placed in attics, sitting rooms, bathrooms, bedrooms, restaurant kitchens, over doors, over windows, or in any location where the visit of the meter reader or tester will cause annoyance to the customer.

In the case of office buildings, or buildings of a similar nature, it is recommended that meters for each floor be grouped and located on each floor respectively.

Height and Spacing of Meters.—All light meters shall have a space provided for each meter 12 in. high and 8 in. wide, and a minimum depth of 8 in., not higher than 8 ft. from floor or platform nor lower than 4 ft.

All power meters shall have a space provided 18 in. square, and a minimum depth of 8 in., not higher than 6 ft. nor lower than 4 ft.

Wiring of Meter Loops.—All meter loops for polyphase service shall be polyphase loops consisting of line wire, load wire and shunt wire for each phase. The shunt wire shall not be larger than No. 12 B. & S. gage.

Meter loops for three-wire service shall be three-wire meter loops consisting of two line wires and two load wires.

In meter loops for installation where service is three-wire but distribution to different consumers is two-wire and loops are installed for each consumer, all shunt wires must be taken from neutral wire, except in cases where regular meter panelboards are installed. All other meter loops must have two lines and two loads. Meter loops for light must have each wire at least 12 in. long.

Meter loops for power must have each wire at least 18 in. long.

When meters are to be installed on brick, stone or concrete walls, a suitable board must be provided and installed by contractor doing wiring to hang meters on. In case meters are to be installed in metal boxes, studs must be provided to support meter.

Inside wiremen are not to take down or move meters, nor are they to leave loops closed.

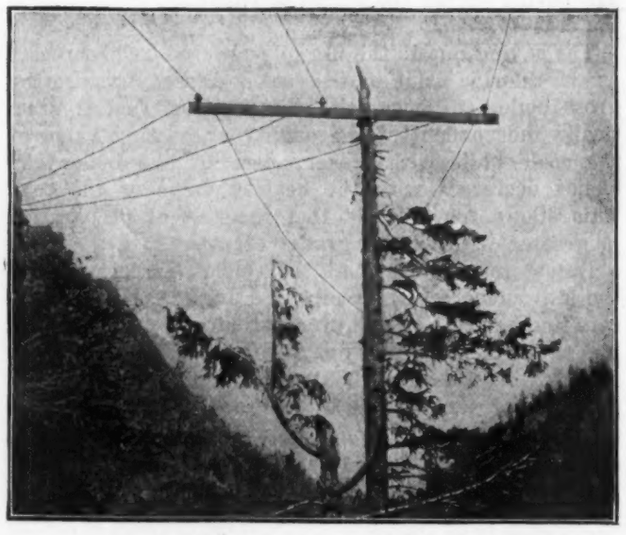
Protection.—When installing additions to old work, the new work shall be put upon the old service, and an entrance large enough to take care of the entire load shall be installed along with a suitable meter loop. The new load shall not be combined with the old load on the old meter without the consent of the meter department. All meter loops for connection to service wires must be run out of the building at a point nearest our secondary distribution and if there is any doubt as to this, the question must be referred to the distribution department.

All meters shall be protected by a fused entrance and with a fused branch block on all loads coming from the meter; this applies to two and three-phase installations as well as single-phase power and light. Except in cases where motors are started without fuses, meter must be protected on the running side.

Motor Installation.—Starting compensators together with overload relays and no-voltage releases are required on all induction motors up to 25 hp. and beginning at 7½ hp. Motors below 7½ hp. do not require special starting equipment with polyphase. Motors 25 hp. and above, polyphase, are to be of the slip-ring type. They are also to be provided with an oil-switch equipment with overload and no-voltage releases. Single-phase motors, 1½ hp. and above, require starting equipment, overload releases and no-voltage releases. The maximum horsepower for single-phase shall be 15 hp.

All wiring jobs requiring motors or new meters must have loops installed according to above rules to insure connections being made.

Tree Used as Temporary Pole for 11-Kv. Line



A SNOWSLIDE having put a considerable part of an 11,000-volt line on the system of the Utah Power & Light Company out of commission, the patrolman made repairs by attaching cross-arms to trees, as shown in the photograph. It may be said in passing that sections of this line operate for months every winter buried completely under snow.

Industrial Applications

The Economical Utilization of Electrical Energy in Mills and Factories, Together with Practical Details of Installation, Control, Testing and Repair of Equipment Required

Maximum Speeds for Motors Recommended by Electric Power Club

MAXIMUM motor speeds for different sizes of belted and geared motors are recommended by the Electric Power Club in a report dated November, 1920, and are extracted in the accompanying table. These recommendations are in line with the other efforts of the club on standardization. Briefly the purposes of the organization are: (a) To describe, classify and define commercial types of electrical machinery, their operating characteristics and the terminology of structural details; (b) to establish commercial rating standards, such as standard voltages, load ratings, time ratings, speeds, etc.; (c) within the general engineering limitations of the Standardization Rules of the A. I. E. E., to establish the kind of rating to be used and the actual performance guarantees under which different types of electrical machinery are manufactured and sold; (d) as far as practicable to establish standards in manufacturing practice and in the structural details of electrical machinery.

MAXIMUM SPEEDS FOR BELTED AND GEARED MOTORS

Speed, R.p.m.	Largest Motor Which Should Run at This Speed, Size, Hp.	
	Belted to High-Speed Drives*	Geared, with Steel Pinions
1800–1700	40	5
1500	50	10
1200–1150	75	25
900–850	125	50
750–720	....	75†

*The above limitations are based on the use of pulleys as standardized by the Electric Power Club. The limitations are higher when motors are belted to slow-speed drives, such as countershafts.

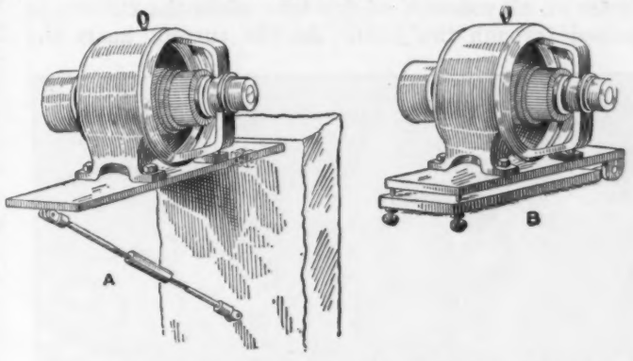
†The use of outboard bearing should be specified for general-purpose motors with geared drive in frame sizes of 75 hp., 850 to 900 r.p.m., and larger.

Tightening Short Belts on Individual Motor Drives

TWO methods of tightening short belts of motors mounted for individual drive directly on the driven machines are employed by the writer. One scheme is to mount the motor on a plate slightly larger than the base of the motor. One end of this plate is hinged and the other is supported on a bar of steel containing a toggle joint with right-hand and left-hand threads (*A* in the drawing). There is a tendency to tip the motor up on one side as the belt is tightened, but the plan has worked very well, and the motor need not tip to any appreciable extent if the belt is kept at about the right length.

In case there is no room for the use of a toggle joint the motor is mounted on a cast plate and the belt is tightened by the aid of two setscrews in a stationary plate below the one upon which the motor is mounted (see *B*). The upper plate is hinged at the side farthest from the setscrews.

By using such devices full benefit of individual drives can be realized. If a motor is so placed that it takes up valuable manufacturing floor space, part of the advantage of individual drive is lost, and, on account of the overhead belting required, the same is true if the motor is placed near the ceiling. These objections can be overcome in many instances by mounting the motor on the machine. This means comparatively short centers between driving and driven pulleys, which requires an idler pulley or some other effective yet simple means of tightening the belt such as those described.



TWO BELT TIGHTENERS USED WITH INDIVIDUAL MOTORS MOUNTED ON MACHINES

ALEX. H. MAY,
Works Engineer.
Canadian Products,
Walkerville, Ont.

Energy Requirements in Butt-Welding Steel and Iron Pipe

ELECTRIC butt welding of steel and wrought-iron pipe has been successfully utilized at the factory of the Whitlock Coil Pipe Company, Hartford, Conn., for about two years. The time required with different currents and voltages and the amount of energy consumed in making welds on various sizes of pipe are shown in the accompanying table.

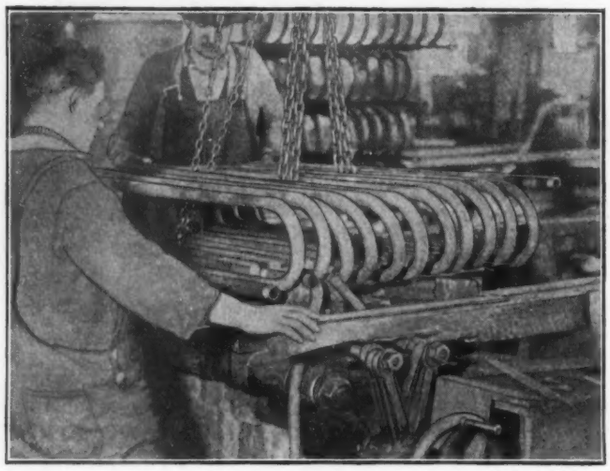
CURRENT, TIME, ETC., OF BUTT-WELDING IRON PIPE

Welder	Size Pipe, In., (Extra Heavy)	Volts	Amp.	Kw.	Kva.	Duration, Seconds
B	1¼	340	95	25	32.5	50
D	1¼	270	180	42	48.5	38
E	1¼	270	190	42	51.5	34
A	1¼	345	160	45	[illegible]	46
C	1¼	345	170	41	58.5	24
B	2	345	108	26	37.5	120
C	2	330	225	55	74.5	35
D	2½	275	190	38	52.5	220
E	2½	268	200	39	53.5	200
C	2½	320	235	55	75	75
A	3	325	215	54	55	235

It is seen from these figures that the all-important factor, time, is practically dependent on the current

alone, higher currents taking less time. It has also been demonstrated in other lines of welding that high currents give the strongest welds. The cost of a typical 1¼-in. extra-heavy butt weld was 15 cents, including labor, material and energy. By the hand methods formerly used such a job required about three-quarters of an hour against an average of thirty-eight seconds when butt-welding with 180 amp. Another advantage of this method over arc or oxyacetylene welding is that the original material is used for making the joint. In a number of tensile tests made in these shops on butt welds locally made the pipe has torn in each case before the weld was damaged in any way.

The butt weld is made by cutting a female scarf in each pipe end. The ends are then pressed together under an oil pressure of five tons while the current is passed through the joint. As the current heats the



PIPE COILS ARE FORMED QUICKLY BY ELECTRIC BUTT-WELDING IN THIS PLANT

ends to be welded, the scarfed portions are thrust outward and the area of the weld is increased over the annular area of the pipe. The inside is not constricted or reduced, but is left smooth and clean. The only objection is that the pipe is increased in outside diameter at the weld, which makes it impossible to use the weld on spiral and other coils made on a former shaped to fit the ordinary outside diameter of the pipe. Where it is essential to secure a weld without reduction of bore or enlargement of outside diameter, lap welding with a mandrel is employed.

G. T. JACOCKS.
Whitlock Coil Pipe Company,
Hartford, Conn.

Care and Operation of Commutators on New Machines

COMMUTATORS on new machines require special attention to insure the best operation and to lessen future troubles. During the first few months that a machine is run under load the commutator is "seasoning." That is, the mica is settling into permanent position and the binding material (usually shellac) is working out from points which are under pressure. During this period the commutator bolts should be tried every two or three weeks while the machine is warm, and if found slack they should be set up tight. In setting up the bolts a little slack should be taken on each one all the way around, then a little more, and so on until all are tight. Where the flange is in short pieces the middle bolt in each piece should be set up first, then the end bolts and then any others in between, giving uniform pressure on the whole flange section. It is possible to set the bolts too tight; hence an extra large wrench should not be used. After the seasoning period the commutator may be out of "true," and if so it should be turned or ground.

A good commutator has a dark-brown color and high polish. When first put in service the copper is raw and pink, but it can be burnished with a hard piece of canvas fastened on a wood block and moistened with a little engine oil. Some grades of brush, particularly soft graphite or "doped" or paraffined brushes, smut the commutator with black dirt and prevent the formation of a good polish; in such a case the smut should be washed off with a rag dampened with gasoline while the machine is shut down. Do not use too much gasoline as it is liable to dissolve grease and dirt and carry them into the mica, where carbonization may take place, causing short circuits in collars or between bars. Kerosene should never be used for cleaning commutators, because it lodges in the mica, never getting dry, and thus causes short circuits to start.

To take down high mica or remove small flat spots or ridges a sandstone, a carborundum block or a piece of an ordinary grindstone can be used. The stone should be anchored so that the man doing the work can give his attention to putting on pressure with no danger of the stone being pulled out of his hands. Often a strap-iron stirrup can be bolted on the brush arm to guide the stone. To avoid glazing the stone, all dirt should first be removed by a damp gasoline rag and vigorous sandpapering until the copper shows pink. Then the stone will be able to cut steadily. After stoning polish with fine sandpaper moistened with a little oil and burnish with a hard, oily rag backed up with a block of wood. During stoning all the brushes should be removed or raised. Careless handling of a commutator stone on a rapidly running machine is dangerous both to the machine and the workman, and care must be used to avoid damage.

Never use waste for wiping off a commutator. The lint will stick to the copper and be carried under the brushes and cause sparking or glowing. Cheesecloth, a piece of clean cement bag or a scrap of overall cloth is much better.

When sufficient lubrication is not given automatically by the brushes it is sometimes advisable to put on a little good engine oil to stop brushes from squealing. The oil should be put on a canvas pad, which is passed over the surface of the commutator. Immediately afterward a clean rag should be used to wipe off the excess oil. Under ordinary conditions no lubrication is necessary. Regular wiping with a dry rag will be enough to keep the surface good.

Most commutator breakdowns are caused by oil getting into the mica and carbonizing. Oil may accumulate from bearings either in fluid form by throwing or creepage along the shaft or by deposit of atomized oil from warm bearings. There are other sources of oil such as overhead cranes that must be watched for. The oil soaks in the mica and collects dirt. After a while the warmth and drying carbonize the oil and the insulating qualities of the mica disappear, allowing breakdown from bar to bar or between bars and ground.

JAMES DIXON.
Reliance Engineering Company,
Cleveland, Ohio.

Motor Arranged for Either 440 Volts or 220 Volts

A MOTOR which will operate on 220 volts or on 440 volts, according to the position of a special switch, was recently connected by the writer for a building contractor whose work changed from one place to another. This contractor had three 10-hp., three-phase squirrel-cage motors. In moving around he encountered first 220-volt service and then 440-volt service. He wished to avoid repeatedly reconnecting his motors or buying duplicates for each voltage. Accordingly, after some study the motor was reconnected as in Fig. 1 and nine leads were brought out so that a series-star or two-parallel-star connection could be made, which

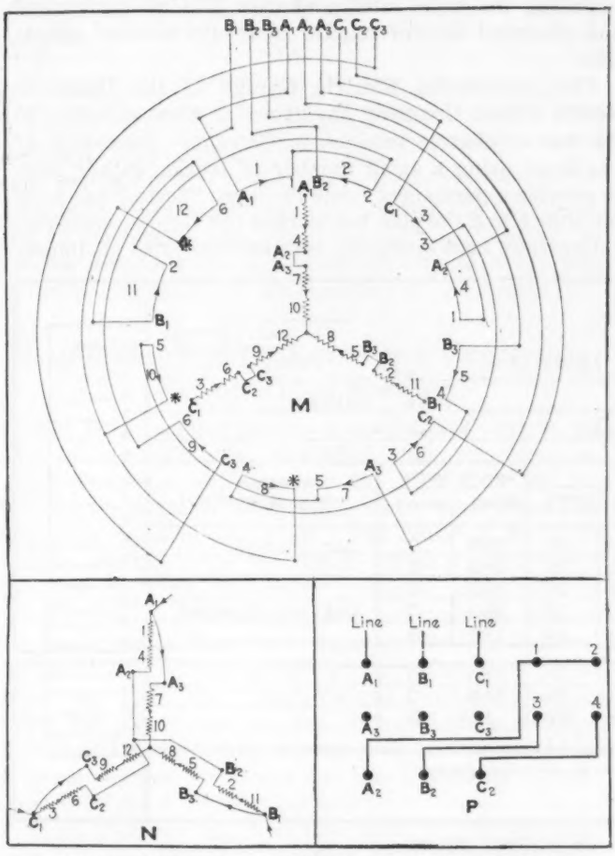


FIG. 1—MOTOR RUN ON 220 VOLTS OR 440 VOLTS BY CHANGING SWITCH

M—Series-star connection for 440 volts obtained by throwing switch *P* down. *N*—Two-parallel star for 220 volts obtained by throwing switch *P* up.

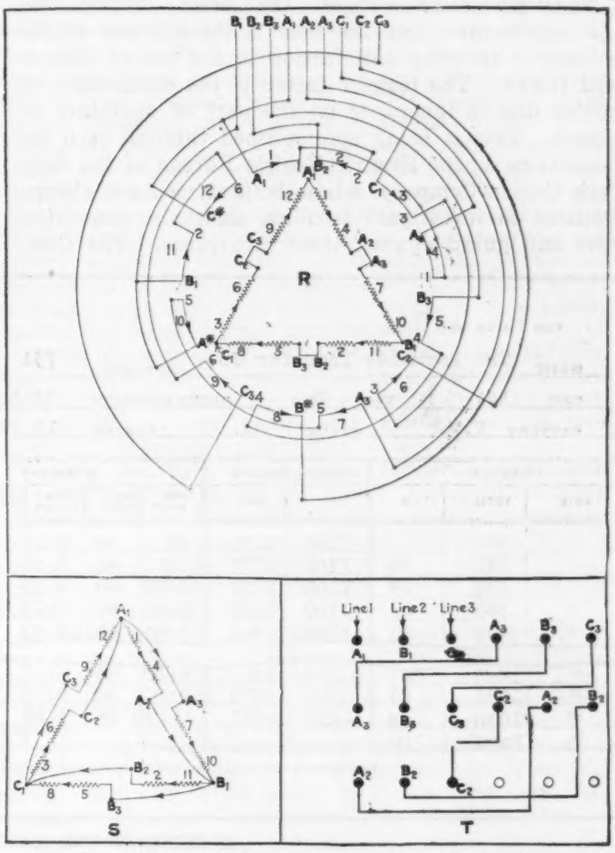


FIG. 2—DELTA-CONNECTED MOTOR FOR EITHER 220 VOLTS OR 440 VOLTS

R—Series-delta connection for 440 volts, switch *T* thrown down. *S*—Two-parallel delta connection for 220 volts; switch *T* must be thrown up.

between the groups 4 and 7 the jumper is cut in half and the ends are brought out to the terminal board.

For 220 volts a two-parallel connection (*N* in Fig. 1) is made by connecting leads A_1 and A_2 to line *A*, B_1 and B_2 to line *B*, and C_1 and C_2 to line *C*. A_3-B_3-C_3 are all three connected together to form the second star connection, which is separate from the star in the motor. The fact of the two star connections being separate does not affect the motor operation.

To simplify the change from one voltage to another a special switch was designed. This was a five-pole, double-throw, 30-amp. knife switch connected as shown in *P* (Fig. 1). The nine leads from the motor were connected to points on the switch marked to correspond. Terminals were fastened to lugs A_1-B_1-C_1 as the line allows operation on 440 volts or 220 volts respectively. Six more holes were drilled in the motor frame and a new terminal block was put on for the nine leads. The small diagram *M* in Fig. 1 shows schematically the series connection. The pole-phase groups are connected in series in pairs; for instance, in the *A* phase group 1 and group 4 are in series. The leads are brought out from the beginning and the end of this series, as A_1 and A_2. Likewise the other two groups of the *A* phase, 7 and 10, are in series, and a lead A_3 is brought out, while the other end is connected to like ends of the *B* and *C* phases, making a permanent star point. The *B* and *C* phases are connected similarly. The only difference between this connection and a straight series-star connection is that instead of putting a jumper leads were always connected to these lugs, and connections were made at the back of switch as shown. When the switch is thrown up for 220 volts A_1 and A_2 are connected to the line and lugs 1-2-3-4 short-circuit A_3-B_3-C_3, thus forming a double star. With the switch down, for 440 volts, A_1 is connected to the line, and A_2-A_3 are tied together. The cover was made so that the switch could be locked open or locked closed on 220 volts or 440 volts. The top of the box was marked 220 on one side and 440 on the other. The switch handle projecting through acted as an indicator. The cover was hinged to prevent reversing the marks.

Fig. 2 shows the method of connection for a 220/440-volt series and two-parallel delta circuits.

Bronx, N. Y. C. A. JOHNSON.

Central Station Service

A Department Devoted to Commercial Policy and Management Topics, Including Methods of Increasing the Use of Electric Light, Power and Heat

Education of User Insures Electric Truck Success

BY SECOR CUNNINGHAM, JR., AND L. T. CARPENTER
Commonwealth Edison Company, Chicago

CO-OPERATION between the central station, the manufacturer and the user is the solution of the problem of insuring satisfaction in the use of electric road trucks. The biggest factor is the elimination of trouble due to ignorance on the part of operators or owners. This is being accomplished through such organizations as the Electric Vehicle Bureau of the New York Edison Company, whose trained men are always available to investigate troubles, assist in remedying them and guard against their recurrence. The Commercial Electric Garage, maintained by the Commonwealth Edison Company of Chicago, and the Electric Vehicle School, maintained by the Board of Education of the city of Chicago, are important steps toward the proper education of operators and garage employees in the handling and care of electric vehicles. Electric vehicle manufacturers are taking similar steps in the opening of garages and the education of users.

Experience indicates that 90 per cent of the difficulties encountered arise from ignorance on the part of the operator or owner. Battery troubles are usually traced to lack of flushing or charging at improper rates, while mechanical difficulties are due principally to lack of proper oiling or other equally simple attention that any piece of mechanical apparatus must have. Unless there is some agency to investigate, indicate the remedy and instruct the operator in proper maintenance methods, dissatisfaction results. The idea that any one with two arms can operate an electric truck has been responsible for much of the difficulty. These trucks are machines requiring the same intelligent care that all mechanical and electrical devices require to insure efficient operation.

The Commercial Electric Garage of the Commonwealth Edison Company has proved a great stimulus to the use of electric vehicles in Chicago. Education of the firms using a small number of trucks, rather than to provide a permanent home for large "fleets," has been the object, and the plan has worked out very successfully.

Carefully kept operating cost records form an important part of any trucking business, and this garage has devoted a great deal of attention to the proper form of record. Above is shown the form upon which the monthly record of every truck is kept. From this record and the garage bills for energy and maintenance the costs of operation, aside from those for general overhauling at approximately eighteen-month intervals, can be readily ascertained. From the records the operating costs and other data on three types of trucks are taken. The trucks were selected as representative of the various service conditions. They are as in accompanying table.

The figures for the 1-ton bus do not include garage charges, since the vehicle was kept in the owner's garage. The figures therefore give the current costs only. The 5-ton truck figures for the winter months

Form C 11 3M 3-20-17

ONCE A MONTH GRAVITY READING OF ALL CELLS

NAME The Parmelee Transfer Co. ADDRESS 731 W. Adams St. DATE June, 1920

CAR 141 TYPE Bus RATED CAPACITY 2000# TIRES Solid

BATTERY K.W. CELLS 42 PLATES 15 Plate TYPE --

MILEAGE			SPECIFIC GRAVITY		CHARGING					AMP. HR. METER		REMARKS
DATE	TOTAL	TRIP	IN	OUT	TIME AT START	AMP. AT START	TIME AT FINISH	AMP. AT FINISH	CHARGE IN K. W. H	DISCHARGE	CHARGE	For additional remarks use other side
1	304		1160	1270	10	40	5:00	12	22	150	0	Car Washed
2	330	26	1160	1270	9:30	40	3:30	12	22	150	0	
3	359	29	1160	1270	8:30	40	4:30	12	27	180	0	
4	386	27	1160	1270	9:00	40	4:00	12	19	160	0	Battery Flushed
5	406	20	1140	1261	7:30	50	12:30	18	19	180	0	
28	1025	27	1145	1265	9:30	40	5:30	13	25	183	0	
29	1052	27	1165	1270	9:00	40	2:00	14	24	168	0	
30	1080	28	1150	1280	11:30	44	4:30	16	26	174	0	
31	Total	776							717			

CELL	GRAVITY
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Blank sheets like this will be mailed upon request, COMMONWEALTH EDISON COMPANY, 72 West Adams Street

MONTHLY RECORD OF 2,000-LB. ELECTRIC TRUCK

The record showed that the truck was operated 776 miles in twenty-nine days, an average of nearly 27 miles per day. Specific gravity of battery on coming in for charge varied from 1.140 to 1.185. After charge battery showed a specific gravity of 1.270, varying slightly from 1.265 to 1.280. Charging rate was started usually at 40 amp., but this varied from 30 amp. minimum to 60 amp. maximum. At end of charge rate was from 12 amp. to 36 amp. A total of 717 kw.-hr. was used during the month, an average of 24.7 kw.-hr. per charge. The ampere-hour meter showed a daily discharge of from 60 minimum to 204 maximum, with an average of 160. During the period the battery was flushed every seven days.

OPERATING COSTS OF ELECTRIC TRUCKS IN CHICAGO

	Five-Ton Truck		Two-Ton Truck		One-Ton Bus	
	Miles	Kw.-Hr.	Miles	Kw.-Hr.	Miles	Kw.-Hr.
May, 1919	537	942	811	611	633	552
June	576	901	757	417	753	700
July	630	955	823	460	886	710
August	471	832	742	550	812	643
September	570	1,010	774	541	755	616
October	416	834	761	548	654	596
November	412	829	637	526	642	578
December	435	1,110	613	589	...	...
January, 1920	419	1,376	602	665	...	...
February	490	1,313	545	529	...	...
March	570	1,356	448	578	...	...
April	750	1,528	550	562	...	...
May	...	...	...	...	...	...
June	...	...	...	...	885	649
Total	6,276	12,986	8,063	6,576	6,020	5,044
Energy per kw.-hr.	....	$0.05	....	$0.05	....	$0.05
Cost of energy	....	649.00	....	329.00	....	252.00
Garage expense	....	444.00	....	264.00	....	5.00
Total cost	....	$1,093.00	....	$593.00	....	$257.00
Cost per mile	....	0.174	....	0.074	....	0.042
Kw.-hr. per mile	....	2.06	....	0.82	....	0.84

Five-Ton Truck.—General heavy trucking. Operated by transfer company in Chicago. Equipped with A-12 Edison battery.
Two-Ton Truck.—Merchant Steel Company. Delivery hauling on Chicago streets. Edison A-8 battery.
One-Ton Bus.—Employed in depot-to-depot passenger hauling in Chicago. Kw-42-15 battery.

indicate by increased energy consumption the bad condition of the roads. This truck has been operated by the transfer company through whatever city territory was necessary, regardless of the condition of the streets.

Wrong Impression Conveyed Regarding Cost of Rural Service

THE letter printed below—a copy of one sent to the *Country Gentleman* of Philadelphia—has been received from the chairman of the committee of the Wisconsin Electrical Association which formulated the Wisconsin rural-service rules. The letter is therefore written not only from the standpoint of a utility operator but also from knowledge gained in an exhaustive investigation in Wisconsin. The rules resulting from the investigation have been approved by the Railroad Commission of Wisconsin for use by a number of companies in that state. The *Country Gentleman* article mentioned (published in the Nov. 20 issue of that periodical) contains the following statement referring to rural service furnished by the Greenville (Ohio) Electric Light & Power Company:

"Until 1919 we had but fifty miles of strictly farm lines. During last year, however, fifty more were built by the farmers themselves. These lines, using 25-ft. poles, are costing from $500 to $650 a mile to build. The average cost for each farmer for building the transmission line is from $200 to $300. We had one line with sixty customers built last summer where the average cost was only $65 each. It cost about $35 from the transformer to the house. The balance is just whatever a farmer wants to spend on equipment and wiring. We have an average of about twenty customers to a line. . . .

"After the line is built the farmers' company makes out a bill of sale for the entire line, excepting transformers and service lines, and turns it over to the power company, which is to maintain and assume full ownership and to be responsible for it in every way, the same as if it had originally constructed it. The company installs and owns the meters."

This gives a wrong impression as to the cost of the equipment necessary to give service and also on the question of the desirability of rural utility companies constructing lines to be operated later by utilities; therefore the protest in Mr. Neff's letter is of urgent interest to utility men. This letter was inspired by the fact that reference was made in the *Country Gentleman* article to the work of Mr. Neff as chairman of the committee dealing with rural electric service in Wisconsin. His communication follows:

The *Country Gentleman*, Philadelphia:

GENTLEMEN: I believe that the article as written if published in the *Country Gentleman* will retard the proper development of the rural electric business.

I firmly believe that the rural lines must be owned by the electric utilities if the best results are to be obtained, and a repetition of the present farmer telephone situation is to be avoided. I will admit that the easiest and safest thing for the utilities to do at the present time is to let the farmers organize companies and operate them. This, however is a very selfish and weak position for the utilities to take. Why should farmers go into the electric business, about which they know little, when there is an organized electric company near them with all the equipment, training and knowledge necessary to give proper service?

To serve a group of farms costs a definite amount of money, and proper service costs a definite sum regardless of whether the farmers organize a company and operate their own lines or whether the utilities operate the lines. What, therefore, is to be gained by the organization of the farmer company? Let the utilities face the proposition squarely and assume their obligation and not force a lot of problems which they are afraid to tackle onto an unsuspecting, uninformed farmer organization.

During these times of difficult financing, when farmers have plenty of money, I believe that the farmers should pay to the utility the cost of the rural extension, including transformers. Proper consideration must, however, be given this payment, arriving at a proper rate.

I believe that the article as written indirectly recommends the organization of farmer companies. Owing to the large circulation of the *Country Gentleman* among progressive farmers this paper has a tremendous influence, and for this reason I feel that a public sentiment will be created by this article which will not be to the best interest of either the farmer or the utility.

I also feel that the cost per mile of farm lines is entirely too low and will have a bad effect. It costs our companies about $1,200 per mile to build these lines, including engineering, overhead, etc. With a copy of your paper in his hand we will have hard work convincing a farmer that this is true. Unless the article is modified as indicated above, I would prefer not to have the farmers of southern Wisconsin see it. The rest of the article is in my mind very well written and contains information that should be given to every farmer.

I am inclosing copy of report which contains the rules governing the taking on of rural customers of some of the largest companies in Wisconsin. Very truly yours,

G. C. NEFF,
General Superintendent.
Wisconsin Power, Light & Heat Company, Madison, Wis.

Indianapolis Utility Steps Out of Its Field to Serve Public

AS A MATTER of service looking toward the good will of the public the Merchants' Heat & Light Company of Indianapolis, Ind., on election night received the Associated Press election returns in its building and in conjunction with the local newspapers threw the returns on a screen. The company's office is located at an important point in the center of the city. Traffic officials had blocked off the street, and it was estimated that about eight thousand people watched the returns. This was an unusual service for the utility to render the public and it received much favorable comment.

Digest of Electrical Literature

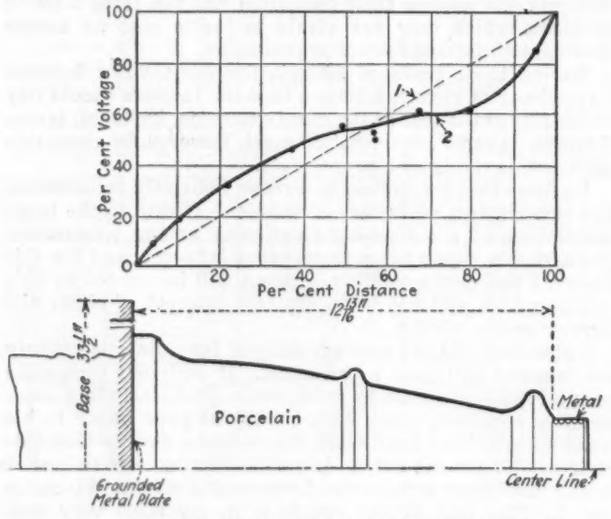
Including Brief Abstracts of and References to Important Articles Appearing in the Scientific and Engineering Press of the World

Generators, Motors and Transformers

Air-Gap Reluctance of Slotted Armatures.—GANS.—The problem is treated in a rather thorough-going mathematical way for the case of an armature with infinite radius and parallel teeth. Expressions for the reluctance per tooth are obtained by complex transformations leading to solutions in the form of elliptic functions and theta functions. In certain practically important cases these solutions are reduced to fairly simple formulas.—*Archiv für Elektrotechnik*, Sept. 20, 1920.

Generation, Transmission and Distribution

Voltage Distribution on High-Tension Insulators.—A. SCHWAIGER.—This author has recently published, as "Mitteilung No. 8 aus dem Hochspannungs, lab. Karlsruhe," the results of an extensive series of measurements of voltage gradients along the spark-over path of insulating apparatus, such as pin insulators, bushings and busbar supports. The Peek definition of the "chain efficiency" of a suspension insulator is used in a generalized sense, the ratio of average to maximum voltage gradient being looked upon as the efficiency of any type of insulator. An ordinary pin insulator has a 45 per cent efficiency, a porcelain bushing about the same, while a condenser-bushing has a gradient ratio of 80 to 90 per cent. A plain, slightly tapered busbar support of porcelain showed about 30 per cent efficiency, while a value of about 75 per cent was obtained with the same support turned upside down so that its widest part was put in contact with the high-tension bus and the narrow end was grounded. The flash-over voltage was 20 to 30 per cent higher in the latter case. The illustration gives representative curve showing the voltage distribution on a Kuhlmann high-tension bushing. The curve shows that by giving the porcelain body a proper form the designer has succeeded in making the gradient at the high-tension end almost exactly equal to the gradient at the grounded end, which clearly means an excellent utilization of the material.—*Elektrotechnische Zeitschrift*, Oct. 28, 1920.



VOLTAGE DISTRIBUTION ALONG A PORCELAIN BUSHING

Electric Power from Tidewater Motions.—Admiral AMET.—A comprehensive memoir dealing with the general problem of a hydro-electric utilization of energy from the tidal motions of the seas. The problem is considered from an economical standpoint, and the inherent technical difficulties are discussed. The author deals with a number of different schemes for obtaining an even power supply during the tidal period and to counteract the lunar variations in the amplitude of the tidewater motions. The isolated tidal plant is said to be uneconomical, a better utilization being obtainable when one or many tidal stations are connected to some distribution system which also has other sources of supply.—*Revue Générale de l'Electricité*, Oct. 2, 9, 16 and 23, 1920.

Traction

Spokane's Traction Problems Are Being Solved.—A description of the interurban system of the Inland Empire, including the supply of energy which is derived principally from a hydro-electric plant on the Spokane River.—*Electric Railway Journal*, Nov. 27, 1920.

Installations, Systems and Appliances

Life and Permanence Tests of Oxide-Film Lightning Arresters.—N. A. LOUGEE.—Operating data obtained during the last five years show, the author says, that little deterioration in the oxide-film cells has occurred. Cells returned from typical installations and tested bear out this statement. In order to obtain information on the life of these arresters several years ahead of reports of those installed, however, an intensive test has been employed during the past few years, and the test methods are described in the paper. The efficiency of the arrester is then discussed from the points of view of sensitiveness, current discharge capacity, reseal and life.—*Journal A. I. E. E.*, November, 1920.

Notes on Rolling-Mill Drives.—L. ROTHERA.—The author states that electricity can be considered almost the accepted form of motive power for rolling-mill drives and that in Great Britain alone more than 500,000 hp. is installed. He points out the lines along which developments in the last few years have occurred and gives data on typical installations for purposes of illustration.—London *Electrician*, Nov. 5, 1920.

The Airplane in Modern Hydro-Electric Practice.—R. C. STARR.—The author states that the application of the airplane in modern hydro-electric practice is receiving its first real test in America in connection with the aërial surveys being made by the San Joaquin Light & Power Corporation in connection with the King's River

hydro-electric project, consisting of eleven plants with a total capacity of 500,000 hp. The most important factors in the design of a hydro-electric project are drainage area, precipitation and run-off. It is held that these may be most accurately determined by means of aërial surveys. Other information, such as the character of timber growth, character of soil and percentage of area exposed to the sun's rays, may also be determined by this means.—*Journal of Electricity*, Oct. 15, 1920.

Electrophysics and Magnetism

Surface Creepage and High-Voltage Insulation.—T. NISHI.—The writer discusses the effect of surface creepage on the potential gradient of insulators and the effect of such voltages on the rational design of high-voltage insulators.—*Journal A. I. E. E.*, November, 1920.

On the Variation of Thermal Conductivity During the Fusion of Metals.—SEIBEL KONNO.—Results of the investigation are summarized as follows: (1) The thermal conductivity of tin, lead, zinc and aluminum decrease with the rise of temperature up to their melting point. (2) For these metals thermal conductivity decreases abruptly during melting. (3) The thermal conductivity of bismuth and antimony slightly decreases at first and then increases a little. (4) During melting the conductivity of bismuth considerably increases, and that of antimony seems to increase only slightly. (5) The thermal conductivity of all liquid metals here investigated decreases but slightly with the rise of temperature. (6) The above changes of thermal conductivity are similar to those of electric conductivity for the same metals.—*Philosophical Magazine*, November, 1920.

Units, Measurements and Instruments

The Magnetic Field Close to an Iron Surface.—LEHRS.—Owing to the high permeability of iron magnetic lines of force tend to leave an iron surface at nearly right angles. As shown by Rogowski, however (see *Archiv für Elektrotechnik*, Oct. 10, 1920), the lines of force sometimes may form a rather acute angle with the iron surface; for instance, if the normal component of field is small, or, in other words, if the magnetic leakage is small. Lehrs has carried this thought further and for certain practical cases has determined the angles of departure of the magnetic-field lines. In certain methods for measuring permeability (Epstein) the exciting field strength is determined by measuring the tangential component of flux in the air just outside the test specimen. It then becomes important to keep track of the magnetic refraction phenomena at the iron surface.—*Archiv für Elektrotechnik*, Oct. 10, 1920.

Emissivity of Heat From Various Surfaces.—V. S. DAY.—The following significant results summarize the investigation reported: (1) The use of thin sheets of asbestos paper on bright tin heat pipes results in a waste of heat. The use should be abandoned. (2) Uncovered bright tin pipes are more efficient carriers of heated air than asbestos paper-covered bright tin pipes. (3) This fact is true regardless of the degree of brightness of the tin surface. (4) No small number of applications of asbestos paper will suffice as an insulator. Several thicknesses are necessary to make a covering equal in this respect to the bare tin. (5) The accumulation of dust and dirt on the pipes does not greatly alter the amount of the loss of the pipes. (6) The heat loss from warm-air furnace pipes covered with one layer of asbestos paper is a serious item in the cost of heating, amounting to more than 5 per cent of the coal consumption, depending upon the number and size of the pipes used. (7) The fact that pipes are partly protected from convection currents of air by joists and studding does not greatly affect the loss. (8) Unless the insulation excels the uncovered bright tin in heat insulation properties it should not be used. (9) Such materials are available and the tests have shown their merit.—*Bulletin No. 117, Engineering Experiment Station, University of Illinois*, November, 1920.

Telegraphy, Telephony and Signals

A New German Submarine Telephone Cable.—What is held to be the largest submarine telephone cable in the world was recently opened for traffic when direct telephone connection was established between East Prussia and Germany over a 160-km. (100-mile) cable in the Baltic. This telephone connection must go over a roundabout route in order to comply with certain regulations in the Versailles peace treaty concerning the "open road" from Poland to the Baltic. The cable contains six pairs of "krarupized" telephone conductors and three single conductors for telegraphic use. The cable has a paper-strip insulation close to the wires and then a lead cover reinforced by a double helix of steel wire with a ¾-in. (19-mm.) pitch. The outside covering is made of jute and compound and is protected by a 5-mm. (0.2-in.) armor made up of twenty-nine galvanized wires of steel with S-section. The outside diameter of the cable is 2 in. (5.08 cm.) and the weight about 11 tons per kilometer (18 tons per mile). The cable was made in three parts, respectively of 21, 77 and 77 km., by the Felten & Guilleaume Carlswerk in Cologne. The attenuation constant of the telephone pairs was found to be 0.015 per kilometer (0.024 per mile), which corresponds to a total attenuation of 2.6. Amplifier stations are installed at both ends, so that the cable can be used in connection with the trunk lines on either side.—*Zeitschrift des Vereines deutscher Ingenieure*, Sept. 25, 1920.

Theory of Antenna Radiation.—A. PRESS.—After considering the previous investigations of antenna radition the author attacks this problem, taking into account the sinusoidal distribution of current and voltage along the antenna. The vertical grounded antenna only is considered. A detailed mathematical investigation of radiation and field strengths at remote points follows. Formulas resembling the Eccles radiation formula and the Cohen dispersion and diffraction factor formula are obtained and interpreted.—*Proceedings Institute of Radio Engineers*, December, 1920.

Multiplex Radio Telegraphy and Telephony.—FRANCIS M. RYAN, J. R. TOLMIE and ROY O. BACH.—The authors classify the chief methods of multiplex radio communication. Duplex and quintuplex radio-telephony and radio-telegraphy over 5 miles (8 km.) at wave lengths around 2,000 m. were experimentally accomplished and are described.—*Proceedings Institute of Radio Engineers*, December, 1920.

Miscellaneous

A New Electric Plow.—DELAMARRE.—A new type of electric farm-labor device, designed by J. Estrade, is described in a well-illustrated article. It is shown that an electric plow of ordinary type weighs three and a half to four times as much as an Estrade plow of the same working capacity.—*Revue Générale de l'Electricité*, Oct. 30, 1920.

THE INCOMING Legislature of New York State is expected to repass the Ferris amendment to the state constitution providing for the development by the state and by corporations of the water powers of the commonwealth. If the amendment is repassed, it will be submitted to popular vote at the next general election.

CONTRACT has been awarded by the State of San Luis Potosi, Mexico, to E. E. Thomas of Tampico for a 100,000-hp. water-power development for hydro-electric and irrigation purposes. This is the first contract of the kind to be awarded by the state since the revolutionary troubles of Mexico began, ten years ago.

THE ACQUISITION by the British Columbia Electric Railway Company of the Western Power Company of Canada has brought about the merger of electrical interests on the lower mainland of British Columbia. A second development on the Stave River is contemplated.

GOVERNOR ALLEN of Kansas will endeavor to have the State Legislature provide for the separation of public utility concerns from the consideration of the Court of Industrial Relations and the reconstitution of the old Public Utilities Commission.

BY THE installation of the first of two 60,000-kw. units the new Colfax plant of the Duquesne Light Company was put into commission last Saturday. Eventually the plant will have six units of this rating.

A BITTER fight over the abolition of the public utilities commission of Arkansas, a project held to have been indorsed in the recent election, is expected when the new Legislature meets.

A STRING of hydro-electric plants along the Tippecanoe River in Indiana is being planned by citizens of that state in co-operation with New York and Chicago capitalists.

APPLICATIONS for preliminary permits or licenses under the water-power act now cover more than 10,000,000 hp., including only 1,500,000 hp. for the California Edison Company's Colorado River project, estimated by some at 3,500,000 hp.

THE AMENDMENT exempting national parks from the operation of the water-power act has been favorably reported to the Senate.

A TEN-MILLION-DOLLAR bond sale is planned by the Pacific Gas & Electric Company of California to be used particularly for financing its Pit River projects.

HOLIDAY demand provides most of the business being done by jobbers and dealers. Wire for lighting and power circuits is in steady demand, but there is no great call for motors and other apparatus. Stocks of motors are better and deliveries quicker. The approaching inventory period prevents any augmentation of jobbers' stocks. Building is as quiet as ever, and collections are about as in the recent past.

News in Brief

Summary of Market Conditions and of Recent and Approaching Happenings of Importance to the Industry

APPROVAL of the direct good-will advertising campaign has been given by the executive committee of the N. E. L. A.

A COMMERCIAL radio service has been opened between New York, Chicago, Detroit and Cleveland.

THREE new issues, totaling $15,250,000 have been reported by electrical utilities this week, the largest being $10,000,000 8 per cent gold bonds of the Kansas City Power & Light Company at par.

PRESIDENT HOOVER has appointed standing committees for the American Engineering Council of the Federated American Engineering Societies.

VERMONT'S new Governor, who takes office next week, is James Hartness, an engineer who was formerly president of the A. S. M. E.

ANNOUNCEMENT is made by the American Engineering Standards Committee that the Electric Power Club has been designated as sponsor for the standardization of terminal markings for electrical apparatus.

THE INDICTMENT charging the Brooklyn Edison Company with a conspiracy to misuse coal priority permits has been dismissed by the United States District Court, as had previously been indictments charging hoarding of coal and a conspiracy to pay more than its fair cost.

VIRGINIA electric light and power companies are, by order of the State Corporation Commission, to put in force a uniform system of accounting.

INCREASED rates at Neenah, Wis., were refused by the Wisconsin Railroad Commission, which said that the electric utility serving that city must satisfy the commission that substantial improvement in its service is being made before the application will be granted.

AWARD of the Janssen medal in astrophysics to Dr. W. W. Coblentz of the Bureau of Standards has been announced by the French Academy of Sciences.

AWARDING the Columbus (Ga.) Power Company a 10 per cent increase in power rates, the Railroad Commission of Georgia also issued an order making it necessary to meter energy on the secondary side of transformers, thus virtually nullifying the increase.

A BILL authorizing the President to invite foreign nations to take part in the proposed Atlantic-Pacific Highways and Electrical Exposition at Portland, Ore., in 1925, has been introduced at Washington.

A BASIC rate for government elctrical workers has been prepared for inclusion in the revised classification bill to be submitted to Congress.

AN INCREASE of 25 per cent in business in 1921 as compared with 1920 is to be sought by the New England Electrical Council.

ONLY raw pipe remains of the steel products which the independent mills were keeping materially above the products of the United States Steel Corporation in price. Merchant pipe is in excellent demand, and the product of the independent mills is quoted about $7 a ton higher than that of the corporation.

INFORMATION received from Germany gives the price in that country of 5-hp. motors, three-phase, 1,500-r.p.m., as $146.90 with exchange at 2 cents per mark. A 30-hp. motor of the same rating brings $504.

LAMP manufacturers have decided to continue in effect their last year's policy of paying as additional compensation the full 5 per cent on the list value of B agents' sales from stock.

DEMAND for small motors rated at from 1 hp. to 25 hp. has fallen off considerably, but the volume of orders received is still fairly good.

RAPID growth of the use of electric trucks throughout the country is reported.

News of the Industry

Chronicle of Important Events and General Activities in the Technical, Commercial and Manufacturing Fields With Announcements and Reports of Association Meetings and Conventions

Governor Allen Advocates Separate Utility Commission

AS A RESULT of experience with the operation of the combined industrial court and public utility commission in Kansas since February Governor Allen is advocating the separation of the public utility section from the Court of Industrial Relations and the reconstitution of the old Public Utilities Commission. While important industrial cases have been handled these have been relatively few, the public utility problems absorbing the energies of the court. It is felt that the utility problems, especially now, are of a nature that justifies a separate body the activities of which shall be devoted entirely to those problems. The industrial court can handle industrial problems better if unhampered by utility matters that in the main bear only a remote relation to the industrial problems over which the court has jurisdiction.

It has also been found that the public has a tendency to confuse the work of the court on industrial and utility matters to an extent that leads to misunderstanding of the court's aims. The separation of the two functions will obviate this difficulty. The whole matter will be presented to the coming legislative session. A lively opposition to the proposal is expected.

Senate Water-Power Act Amendment Favorably Reported

THE amendment to the water-power act providing that no permit is to be granted for the construction of project works in national parks has been reported favorably to the Senate by the committee on commerce. The amendment was reported in exactly the language of the draft which was prepared by the Secretary of the Interior. The vote in the committee to report the amendment was unanimous.

Power Club to Act as Sponsor for Terminal Markings

THE American Engineering Standards Committee announces that the Electric Power Club has been designated as sponsor for the standardization of terminal markings for electrical apparatus. A sectional committee responsible for the work and upon which all organizations interested in the subject will be officially represented is being organized.

At the Brussels meeting of the International Electrotechnical Commission in March, 1920, some of the European delegates proposed a method for marking terminals of transformers. The American delegates suggested that it would be preferable to treat the more general subject of terminal markings for electrical apparatus consistently. As a result the Americans were requested to propose a systematic plan covering the whole subject.

The Electric Power Club has already done a large amount of work on these lines and has developed a general plan which is in wide use among American manufacturers. Parts of the plan, particularly the part relating to transformers, have been adopted by other organizations, including the American Institute of Electrical Engineers and the National Electric Light Association.

It is hoped to obtain agreement of all interested bodies on a general plan for representation at the next meeting of the International Electrochemical Commission.

New England Electrical Interests Propose 25 per Cent Growth in 1921

ONE of the largest and most important meetings ever staged by electrical interests in New England is now being planned for Jan. 26 at the Boston City Club, under the auspices of the New England Electrical Council, with the co-operation of all four branches of the industry. The prime object of the meeting, which will take place at the close of a dinner set for 6:30 p.m., is to increase more friendly relations throughout the branches and to create such relationships as will increase electrical business 25 per cent in 1921. Bowen Tufts, president New England Geographic Division, N. E. L. A., will preside.

California Placing New Rules in Its Utilization Safety Orders

THOSE rules which more than four years of actual field experience have shown to be necessary for the proper enforcement of the safety code now in operation and to promote the security of employees of industrial plants will, according to a statement made by R. L. Eltringham, electrical engineer of the Industrial Accident Commission of California, to the ELECTRICAL WORLD last week, be incorporated in the electrical utilization safety orders of the commission.

"The present orders govern the installation and use of electrical apparatus and wiring devices," Mr. Eltringham said, "in so far as the safety of the workers is concerned. In some instances the code has not fully covered all of the features that the commission felt should be covered, and for this reason the inspectors have found it advisable to use and enforce portions of the National Electrical Code devised by the fire underwriters. Thus in actual field inspections the inspectors have constantly referred to the National Electrical Code and have found it almost impossible to separate the provisions and intent of the two codes. For this reason it is now necessary to take certain portions of the National Electrical Code, portions of various city and

municipal codes and portions of all other available codes and incorporate them in the California code. When this work is completed the code will still be entirely an electrical safety code, but it will recognize that there are personal hazards due to possible fires caused by improperly designed or improperly installed electrical devices.

"The code as it stands and as it will grow has police power behind it, and no sacrifice to commercial desires can be possible. Instances are known where the National Electrical Code provisions were set aside by those presuming to enforce them as such enforcement would be detrimental to the rating companies.

"In no sense is the enlarged California code a combination of the Bureau of Standards Safety Code with the National Electrical Code as such, because it is known that portions of both of these codes are antiquated or are impossible of application and the placing of the two codes in one volume would not correct this. The California code is a separate and distinct code which embodies the best of all available codes and has been compiled largely by the interested and experienced men in the industry in the state."

Brooklyn Edison Not Guilty of Lever Act Violations

JUDGE MAYER of the United States District Court on Monday sustained the demurrer of the Brooklyn Edison Company and of Walter F. Wells, its vice-president, to the indictment returned Oct. 4, 1920, which charged conspiracy with B. J. Lynch Coal Company and others to misuse I. C. C. coal priority permits. Three indictments were returned on Oct. 4 against the Brooklyn Edison Company, charging (1) the hoarding of coal, (2) a conspiracy to pay more than the fair cost of coal by way of bonuses to the Adelphia Coal Company, and (3) a conspiracy to misuse priority permits for the advantage of the B. J. Lynch Coal Company.

Demurrers of the Edison company to the first two of these indictments were sustained by Judge Mayer Nov. 10, at which time he reserved decision on the demurrer to the third indictment. The decision then reserved was handed down this week sustaining the contention of the Edison company and of Mr. Wells. By these decisions the court held that the Edison company and Mr. Wells had not been guilty of violation of the Lever act.

New York Rates Adjusted on Coal Basis

EFFECTIVE Dec. 1, all the energy rates in the tariffs of the New York Edison Company, the United Electric Light & Power Company and the Brooklyn Edison Company, as has been previously announced, are to be adjusted monthly on the basis of the increase in the price of coal over the price when the previous rate was authorized. In order to bring the reasons for this action before its customers in such a way that it might not be misunderstood the New York Edison Company has placed the following letter in the hands of all of its consumers:

Permit us to announce that on and after Dec. 1, 1920, an adjustment charge will appear on our bills to offset partly the present abnormal cost of coal. This adjustment is in accordance with our schedules relating to rates and service conditions on file with the Public Service Commission for the First District, and is made on the principle of the "sliding scale," rising or falling with any increase or decrease in the cost of coal. It will entirely disappear if and when this cost returns to the basis upon which the existing rate schedules were established.

When these schedules were adopted we were most apprehensive of future conditions, and the right was then reserved, as is shown by the records of the Public Service Commission, to increase our rates by 1 cent a kilowatt-hour, should conditions justify. Notwithstanding the constantly rising cost of coal, labor and supplies, with which all are familiar, we hoped to get through the entire war and readjustment period without making any change in our schedules. This would have been accomplished as planned, probably, were it not for the abnormal increase in the cost of coal which has now reached a point where it can be carried no longer without jeopardizing seriously the financial position of the company.

The adjustment for low tension service is 0.050 cent a kilowatt-hour for each increase or decrease of 10 per cent above or below the average cost of coal of $3 a ton in 1916, when the present rate schedules were adopted. The actual increase in the cost of coal in each of the 10 per cent steps during the past three years has been slightly in excess of 0.057 cent for each kilowatt-hour; hence we shall continue to bear part of the increased cost of coal over the prevailing averages of 1916, and, in addition, the entire added cost of labor, material, supplies and taxes. We shall endeavor to carry these elements of additional cost throughout the present period of readjustment, trusting that it may not be necessary to ask the Public Service Commission for any further modification of our schedules through which the cost of the service would be increased.

Under an order from the Public Service Commission for the First District the exact cost of coal is reported from month to month, and this adjustment is covered by a monthly rider which is on file at the offices of the Public Service Commission, as well as all of the offices of this company, where it may be consulted at any time. Upon request we shall be glad to furnish any further information desired concerning this adjustment.

It will be apparent that under the "sliding-scale" principle upon which this adjustment is based any reduction in the cost of coal will immediately accrue to the benefit of the consumer. This company is of course in no way responsible for any of these increases in the cost of service. On the contrary, they have been largely, if not entirely, the result of the war and post-war conditions, and many were either approved or actually established by the federal government at Washington as a necessary feature of our part in the great war effort.

In applying the added coal cost to each kilowatt-hour of the entire service of the company the result is spread over a very wide area. It is small as related to the kilowatt-hour, and is practically negligible to a very large percentage of our customers. However small the amount we greatly regret that any necessity to modify our schedules should have arisen, and trust that with the anticipated early return to normal conditions this element of adjustment may speedily disappear. THE NEW YORK EDISON COMPANY.

Ten-Million-Dollar Bond Sale Planned by California Company

FOR the purpose of obtaining funds with which to carry on its hydro-electric construction program the Pacific Gas & Electric Company of California has planned a bond issue of $10,000,000 of 7 per cent twenty-year bonds. It has not been decided at what prices the bonds will be sold. The proceeds of the bond sale are to be used particularly for what is known as the Pit River projects of the Mount Shasta Power Corporation, which is a subsidiary of the Pacific Gas & Electric Company. It is estimated by the company that contemplated betterments and additions to its properties for the years 1921 and 1922 will cost in excess of $20,000,000.

Approval Given to N. E. L. A. Direct Good-Will Advertising

APPROVAL of a direct good-will advertising campaign over the name of the National Electric Light Association was given by the executive committee at its meeting on Dec. 16. This campaign is designed to take in the present good-will campaign conducted by the use of pamphlets and also the good-will campaign cooperated in by the electrical manufacturers. Definite plans already have been made, and the advertisements will begin to appear in popular magazines within the next six weeks or two months, supplementing the advertisements of the manufacturers.

President Insull stated that upon the request of the public policy committee he had appointed a committee on co-operation with other associations to meet similar committees from the American Gas Association and the American Electric Railway Association. The committee appointed by him and ratified at this meeting includes S. Z. Mitchell, Charles L. Edgar, H. G. Bradlee, W. W. Freeman, Joseph B. McCall, John W. Lieb, O. D. Young and Martin J. Insull, ex officio.

President Insull was authorized by the executive committee to take up with the chairmen of the four national sections and the headquarters staff the matter of fixing the time and place for the 1921 convention.

Week Brings $15,250,000 New Financing

THREE new issues totaling $15,250,000 were reported this week. The largest was $10,000,000 first and refunding mortgage twenty-year 8 per cent gold bonds, series A, of the Kansas City Power & Light Company at par. The Consolidated Gas, Electric Light & Power Company of Baltimore, Md., sold a five-million-dollar issue of first and refunding mortgage sinking-fund 7½ per cent gold bonds, series B, at a price to yield the investor 7¾ per cent. The third issue was $250,000 of five-year 8 per cent collateral trust gold notes of the Consolidated Utilities Company at 98, to yield 8½ per cent.

The proceeds from the Baltimore issue and some additional cash will provide $5,625,000 for refunding $468,000 in maturing notes and for additions and extensions to be completed before the end of 1921. The proceeds from the Consolidated Utilities issue are to pay for extensions and betterments.

Standing Committees of Federation Appointed

A MEETING of the executive board of the American Engineering Council of the Federated American Engineering Societies was held in New York on Dec. 17. At this meeting President Hoover appointed the following standing committees: Committee on procedure, Calvert Townley chairman; committee on constitution and by-laws, W. B. Powell chairman; committee on publicity and publications, L. P. Alford chairman; committee on membership and representation, J. F. Oberlin chairman; committee on finance, William McClellan chairman; committee on public affairs, J. Parke Channing chairman.

Mr. Hoover stated that in various cities he had visited lately he had found a general desire on the part of engineers to join in the federation movement, but that there was a general trend toward territorial organization. This question was referred to a special committee.

The American Engineering Council has offered to take over the employment service in which the four so-called founder societies have been associated. An appropriation of $1,000 was authorized as an initial fund to carry on publicity work.

Fight Over Abolition of Arkansas Commission Expected

A BITTER fight is expected in the State of Arkansas soon after the first of the year over the public utilities commission. The incoming administration, which will be headed by Governor-elect McRea, was elected on a platform one of the planks of which called for the abolition of four state commissions, including the public service commission. Such action, however, cannot be taken except by legislation.

The matter came to a head a few days ago when Governor Brough was called on to appoint a member of the commission to fill a vacancy. He asked Governor-elect McRea to assist him, but the latter declined on the ground that the people by their vote had indorsed the commission abolition plank.

New England N. E. L. A. Good-Fellowship Dinner Notable Success

FOUR hundred members of the New England Division of the N. E. L. A. joined in a "good-fellowship" dinner at the Edison Service Buildings, Boston, on Dec. 17. The occasion was marked by the reading of eight prize papers setting forth the advantages of membership in the association, the competitors representing the technical, accounting, public policy and commercial sections of the New England division, and by addresses by Bowen Tufts, president New England Division; Charles L. Edgar, president Boston Edison company and vice-president New England Division; M. H. Aylesworth, executive manager N. E. L. A.; G. M. Guilford, chairman Accounting Section, New England Division; L. L. Elden, chairman Technical Section; H. T. Sands, chairman Public Policy Section, and F. J. Allen, speaking for V. M. F. Tallman, chairman Commercial Section.

L. D. Gibbs, Boston, presented a lantern-slide résumé of the careers of seventeen leading electrical men in New England whose successes have been closely interwoven with N. E. L. A. membership and work. The prize winners were: Technical, first, Gilbert Robinson, Boston Edison company; second, Russell Hastings, Boston Edison company. Public Relations, first, C. R. Hayes, engineering manager Charles H. Tenney & Company, Boston; second, Welles E. Holmes, manager Cambridge Electric Light Company. Accounting, first, Daniel Goss, Boston Edison Company; second, A. G. Havlin, Boston Edison company. Commercial, first, J. H. Griffin, Jr., Boston Edison company; second, C. Ernest Greenwood, superintendent appliance department, Boston Edison company. To R. B. Merrill, Boston Edison company, was awarded a year's membership in the New England Division for cartoon work on behalf of the organization. The prizes were presented in person by Executive Manager Aylesworth amid the enthusiastic applause of the audience.

Virginia Utilities to Have Uniform System of Accounting

A UNIFORM system of accounting for all electric light and power companies in Virginia is to be installed on Jan. 1 at the request of the State Corporation Commission, which will provide blank forms for the use of the companies in making their reports. Before issuing its order the commission held several conferences with representatives of the companies concerned, and the subject was thoroughly canvassed.

Colfax Plant Added to Pittsburgh Power Supply

LAST Saturday the first of two 60,000-kw. units of the new Colfax plant of the Duquesne Light Company of Pittsburgh was placed in service in the presence of a large gathering of the city's business men. The plant, which was designed by Dwight P. Robinson & Company, is to have an ultimate capacity of six 60,000-kw. units, which will make this one of the largest generating plants in the world.

This plant will be part of the transmission ring being formed around the Pittsburgh district. Energy is delivered to the district at 66,000 volts from both the Colfax and the Brunot's Island plants and reduced in substations to 22,000 volts and 11,000 volts for distribution over radial feeders into the business district.

Edison Pioneers Elect New Members

NEW members and associate members of the Edison Pioneers were elected at a recent executive committee meeting as follows: Members (men associated with Edison or connected with his work up to 1885 and their descendants)—John W. Lawson, San Ysidro, Cal.; Hermann Lemp, Erie, Pa., and W. H. Brenner, Atlanta, Ga. Associate members (men associated with Edison or connected with his work in the period from 1886 to 1899)—William Slocum Barstow, New York; Walter H. Johnson, Philadelphia; Fred M. Kimball, Boston; W. W. Freeman, Cincinnati; Harry Thomas Edgar, Boston; Walter S. Mallory, New York; Montraville Wood, Berwyn, Ill.; C. H. Pennoyer, San Francisco, and Martin Insull, Chicago.

There are now about a hundred members in each of the two classes. The annual meeting of the society will be held on Feb. 11 next, Edison's seventy-fourth birthday.

Bill Would Authorize the Federal Power Commission to Employ Personnel

TO AUTHORIZE the Federal Power Commission to employ personnel directly, as well as to retain those detailed to it by other departments, Representative Esch, the chairman of the committee on interstate and foreign commerce of the House of Representatives, has introduced the following amendment to the water-power act:

In the performance of its work the commission shall utilize in so far as practicable the field offices and field personnel of the Departments of War, Interior and Agriculture, and it is authorized to employ in the District of Columbia and elsewhere such expert, technical, clerical and other personnel as may be necessary for the purpose of performing the duties imposed by this act and as may be from time to time appropriated for by Congress. The detail of persons for such purpose from the Departments of War, Interior and Agriculture, or the transfer from such departments of any persons engaged in duties which by this act are conferred upon the commission, is hereby authorized, and the restrictions on transfers from one executive department or independent establishment to another imposed by the acts of Congress approved June 22, 1906, and Oct. 6, 1917, shall not apply to such transfers so made.

All the expenses of the commission, including rent in the District of Columbia, personal services in the District of Columbia and elsewhere, reimbursement of other government departments or agencies for expenses incurred in the performance of work for the commission, necessary printing and binding, purchase of equipment, supplies, law books, books of reference, periodicals and directories, all necessary expenses for transportation and subsistence, including, in the discretion of the commission, a per diem of not exceeding $4 in lieu of subsistence incurred by its employees under its orders, or by employees of other government departments or agencies engaged upon the work of the commission, in making any investigation or conducting field work, or upon official business outside of the District of Columbia and away from their designated points of duty, shall be allowed and paid on the presentation of itemized vouchers therefor approved by a member or officer of the commission duly authorized for that purpose; and in order to defray the expenses made necessary by the provisions of this act there is hereby authorized to be appropriated such sums as Congress may hereafter determine, and the sum of $100,000 is hereby appropriated out of any moneys in the Treasury not otherwise appropriated, available until expended, to be paid out upon warrants drawn on the Secretary of the Treasury upon order of the commission.

The amendment also provides that the salary of the executive secretary shall be increased from $5,000 to $7,500.

Intermountain Utility Commissioners Would Form Association

MEMBERS of the public utilities commissions of Utah, Nevada, Montana and Idaho, who recently concluded a conference at the State Capitol in Salt Lake City with a general discussion of problems common to all, found the exchange of ideas and general discussions so helpful that the formation of an Intermountain association of utilities commissioners was very much in favor. It was pointed out that problems common to all the Intermountain country might be discussed at meetings of such an organization and it was suggested that some sort of a sectional meeting might be held with a view to uniform presentation of views to the National Association of Railroad and Utilities Commissioners.

In the absence of some members of the visiting commissions no action could be taken. It was left with Judge Joshua Greenwood, president of the Utah commission, to correspond with other commissions.

Commissioners Skeptical About Service at Cost

A DECIDED tendency to skepticism concerning the plan to solve public utility rate problems by allowing them to furnish service at cost has become manifest on the part of some public service commissioners. This basis of return has been advocated especially for street-railway companies, and service-at-cost plans have been worked out in Cleveland, Cincinnati, Boston, Montreal and other places that met at the time of their proposal with much commendation from the members of regulating boards. A plan along these lines was proposed for Indianapolis and at first aroused the enthusiasm of most of the Indiana commissioners, including E. I. Lewis, the chairman of the body. These commissioners, however, as a result of careful investigation of results attained under the method, have altered their opinion, and in a recent address before the National Municipal League Mr. Lewis gave expression to the following view:

"I fear that service at cost simply means that the lid is taken off. It is possible that some time in the future some workable plan incorporating incentive for efficiency and initiative will be worked out. While the commission does not pass finally on service at cost, nevertheless it seems to most of us to run contrary to human nature, which, at least in business, requires opportunities of a struggle for gain. Psychologically, the blocking out of rates which shall apply if operating expenses increase threatens to become an open invitation for laxity."

Special interest to electric light and power companies in such an altered viewpoint on the part of regulating bodies resides in the probable spread of its application to other utilities. Commissioners already in various states are giving evidence that the coal clauses no longer meet with approval.

N. E. L. A. Backing Lamp-Voltage Standardization

FURTHER stimulus to the standardization of lamp voltages is being given by the lamp committee of the National Electric Light Association. Fully 80 per cent of the large lamps now manufactured are for 110, 115 and 120 volts, and in order to reduce the use of lamps of other voltages the committee is asking N. E. L. A. member companies to indorse these voltages. A questionnaire has gone forth to member companies asking when one of the standard voltages will be used, the voltage now used, and, if no standard voltage is used or has been arranged for, whether such is contemplated and if so of what voltage.

Highway and Electrical Exposition Planned for 1925

A BILL authorizing the President to invite foreign nations to take part in the Atlantic-Pacific Highways and Electrical Exposition at Portland, Ore., has been introduced in the United States Senate by Senator Chamberlain. The exposition is to be held in 1925. The bill provides that whenever it shall be shown to the satisfaction of the President that adequate funds are available for the purpose of carrying forward the exposition he may issue the invitations to other nations.

The exposition is to celebrate the centennial of the invention of the electromagnet and in honor of the completion of transcontinental and Pacific highways.

Kansas Looks Toward Development of Water Power Under State's Auspices

THE pressing need of an economical power supply in Kansas for the development of both industrial and agricultural industries was urged by Dean Walker of the School of Engineering of the University of Kansas in discussing the proposed revision of the method of handling Kansas water resources before the state water congress held recently at Topeka. Industrial development has reached a point where manufactured products, not including coal and petroleum, exceed in value the state's agricultural products, and it is therefor necessary that the most careful survey of the state's water resources be made to determine their value in connection with irrigation and for power purposes, as well as for industrial and domestic water supply, Dean Walker asserted. Six commissions now deal with various phases of the state water supply, and it is proposed to bring in a bill at the next legislative session which will provide for control of the state's water power by a division of water resources to be created as part of the Court of Industrial Relations. All technical service as well as investigations relating to hydro-electric properties and dependent rate matters would be handled by it. A committee of five, representing all interests, was appointed to co-operate with the Governor and the Water Commission in drafting the bill.

Janssen Medal Awarded to Dr. W. W. Coblentz

THE Janssen medal has been awarded by the French Academy of Sciences to William Weber Coblentz of the staff of the Bureau of Standards, Washington, D. C. The Janssen prize, consisting of a gold medal and founded by Jules Janssen in 1886, is awarded biennially by the French Academy of Sciences as a reward for a discovery or a work marking important progress in astrophysics.

The recipient of this year's reward is of Swiss-French descent. He is forty-seven years old and has been in the Bureau of Standards since May, 1905. The medal

DR. COBLENTZ AT WORK IN HIS LABORATORY

is awarded for his investigation of infra-red radiation from terrestrial sources and from stars.

Dr. Coblentz was a frequent contributor to the ELECTRICAL WORLD about twelve years ago, when the new incandescent-lamp filaments—tantalum, tungsten, osmium, etc.—came into use. His contributions to the subject of illumination have been mainly along the line of experimental analysis. He attacked successfully the problem of the high luminous efficiency from the standpoint of the spectral absorption and reflection of the metals, in the form of highly polished mirrors—in recognition of which the Franklin Institute awarded him the Howard N. Potts gold medal—and also by spectral emission of the incandescent-lamp filaments. A study was made of the emission spectral of numerous oxides, etc., in the form of rods similar to the Nernst glower. Life tests were made of quartz mercury-vapor lamps, and the ultra-violet component radiations of the sun and other light sources were determined.

Secondary Metering Nullifies 10 per Cent Rate Increase

THE Railroad Commission of Georgia has handed down a decision in answer to the application of the Columbus Power Company for an increase in power rates, the rates in the order as issued giving the company an increase of approximately $60,000 per annum, or 10 per cent over and above the old rate schedule. However, an order of the commission which provides for metering on the secondary, instead of the primary, side of the transformers will virtually nullify the increase as granted. In all probability, the Columbus Power Company will ask for a rehearing of the case.

Registration for Engineers and Architects Proposed in Ohio

A BILL providing for the registration of engineers, architects and surveyors is to be introduced into the Ohio Legislature this winter. Legislation along similar lines is now in force, according to advocates of the bill, in eleven states. The bill was drawn by a committee of the Association of Ohio Technical Societies and is described as the result of nearly twenty years' "spasmodic agitation." By its terms registration may be made under any one of three titles, engineer, architect, or surveyor; but registration under either of the first two titles permits practice over the entire technical field.

Administration will be vested in a board of eight members, appointed by the Governor and serving without pay. The membership of the board shall include at least three professional engineers and three architects.

Fees for registration are to be $25 with examination and $10 without, and the certificate does not require renewal. To issue or revoke a certificate will require the affirmative vote of not less than five members, two of whom must be engineers if an engineering certificate is sought. "Practicing or offering to practice" in violation of the act will constitute a misdemeanor, punishable by fine, imprisonment or both.

American Bureau of Welding Reorganized

AT A MEETING held in New York recently the American Bureau of Welding was reorganized as joint advisory board of the engineering division of the National Research Council and the American Welding Society on welding research and standardization. The advisory board consists of representatives appointed by the American Welding Society, other interested scientific and engineering societies and organizations, classification societies, government bureaus and certain members at large appointed because of their special ability in matters pertaining to welding research and standardization. At this reorganization meeting by-laws were adopted and the following officers elected: Director, Prof. C. A. Adams; first vice-director, H. M. Hobart; second vice-director, Prof. A. S. Kinsey; secretary, W. Spraragen.

The bureau voted to create eight research committees, namely, on electric arc welding, gas welding, welding wire specifications, welding of storage tanks, welding conference, thermit welding, resistance welding and specifications of steel to be welded. The committees on welding of storage tanks, welding wire specifications and the welding conference are already actively at work.

The welding conference committee, of which A. S. Kinsey is chairman, plans through questionnaires to obtain a large amount of detailed information on all of the elements which have entered into the successful welding of pressure vessels in the past.

The committee on welding of storage tanks, of which J. C. Lincoln is chairman, was organized to meet the requests for information from the Standard Oil Company as to the proper procedure for welding storage tanks for holding light oils.

The committee on welding wire specifications, of which C. A. McCune is chairman, has been actively engaged in collecting data as to the chemical analysis of welding wire used for both gas and electric welding in the railroads, shipyards and other places and the service results obtained from the use of such wire. From these data the committee expects to obtain sufficient information to enable it to draw up specifications as to the proper limits of the chemical content of welding wire to be used for different purposes. Specifications have already been completed for wire to be used in welding mild steel and will be extended to include the welding of high carbon, alloy steel and non-ferrous metals.

British Columbia Power Interests Consolidated

BY ACQUIRING control of the Western Power Company of Canada the British Columbia Electric Railway Company of Vancouver, B. C., has brought about the merger of electrical interests on the lower mainland of British Columbia. The acquisition was accomplished mainly by the British Columbia Electric Railway Company guaranteeing the $5,000,000 of Western Power Company bonds. The latter company, formerly known as the Western Canada Power Company, had a capital of $11,350,000. Its plant develops 39,000 hp. at Stave Falls, 31 miles from Vancouver, and, besides selling 75 per cent of its output to the British Columbia Electric Railway, it transmitted power to the Puget Sound Power & Light Company at Sumas, Wash., and retailed energy in the vicinity of Vancouver and New Westminster.

There have been only two power companies in the field in the vicinity of Vancouver, the British Columbia Electric Railway Company, with plants at Lake Buntzen developing 84,000 hp., and the Western Power Company of Canada. The former company purchased 15,000 kw. from the latter and was under the necessity of acquiring more power. The capacity of the Western Power Company's plant is 150,000,000 kw.-hr. a year, but by the raising of the dam and the installation of another unit its output can be increased to 200,000,000 kw.-hr. a year. The plant would then have a total horsepower of 52,000. It is expected that work on the additional unit will be undertaken immediately by the British Columbia Electric Railway Company, the cost being estimated at $1,000,000.

The Stave River affords opportunity for a second development, the site of which is also conveyed in the deal, 3½ miles below the present plant. On this site 80,000 hp. to 90,000 hp. could be developed on a 50 per cent load factor. The cost would be $8,000,000. It is not expected that development work on the second site will be necessary for two or three years at the present rate of increase in demand.

With the acquisition of the Western Power Company the British Columbia Electric Railway Company will have an investment in the province of about $65,000,000.

Radio Service Opened Between New York, Cleveland, Detroit and Chicago

ON DEC. 16 a radio service was opened between New York, Cleveland, Detroit and Chicago by wirelessed exchanges of greetings among the Mayors of the four cities. This intercity wireless system applies the same methods that have been applied successfully in overseas service. Wireless apparatus developed by Emil J. Simon is used for sending and receiving stations, which are remote-controlled from a downtown office.

Current News and Notes

Timely items on electrical happenings throughout the world, together with brief notes of general interest.

Elmira to Have Electrical Show.—The Elmira (N. Y.) Electrical Association will hold its first annual electrical show on Jan. 22 to Jan. 29 inclusive. H. S. Bryan, 210 East Water Street, Elmira, N. Y., is the general manager.

Lighting Exhibit for Kansas City's School System.—A permanent industrial lighting exhibit is being arranged for the trade school which is conducted as a part of the public school system of Kansas City. It is intended that this exhibit shall be used by the commercial interests of the city as well as in the instruction of the trade school students.

Electric Trucks in New York City.—The sale of 525 electric trucks in New York since the first of the year brings the total number in use there up to 4,525, according to the *Edison Monthly*. These range all the way from a single vehicle up to big "fleets" and represent an investment of $22,750,000. Up to Nov. 1 the number of vehicles sold was five and one-half times as many as in the same period last year.

A Five-Million-Dollar Texas Hydro-Electric Plant.—Construction of a dam across the Leon River three miles from Eastland, Tex., which has just been completed, assures the operation by the Oil Belt Power Company of a 10,000-hp. hydro-electric plant, on which $5,000,000 has been expended. Energy from this plant will be transmitted throughout the oil fields of central west Texas to pump and possibly to drill wells. It is asserted that electric pumping will increase the yield of the wells in this section fully 10,000 barrels a day.

Electroculture and Electrical Power Applications on the Farm.—An English contemporary, *Electrical Industries*, waxes satirical over a too flowery report emanating from the Ministry of Transport and dealing with "The Electric Age" as the official Commissioners of Electricity see it. The picture painted of mains extending everywhere "throughout the big electricity districts" the electrical journal regards as of a strictly Futurist character because of the vast financial problem involved, and of he official association of electroculture with rural electrical power it says that to make the assertion that "not only will richer harvests be obtained by the use of electricity, but plowing, harrowing, reaping, binding and threshing will be carried out by electrical appliances," is like saying that "not only will electricity be used for lighting cigars in the managing director's office, but the driving of cranes, rolling mills and machine tools will also be carried out by electrical appliances!"

Radio Helps Out Wall Street.—For the first time in the history of Wall Street the wireless telegraph supplanted the ordinary telegraph lines a week or two ago in the carrying on of stock market operations between New York and Chicago. The wire lines were disrupted by a storm and during the final hour of trading on the New York Stock Exchange W. J. Wollman & Company conducted business with Clement, Curtis & Company of Chicago by wireless. The plan worked with such perfection that Mr. Wollman, who instituted the new procedure, declared that it was a tremendous step forward and precluded any possibility of New York being isolated from the rest of the country because of storms.

Informal Complaints Against California Utilities Average Only Seven a Day.—From July 1, 1919, to June 30, 1920, the California Railroad Commission received, according to its annual report, 2,663 informal complaints, of which 467 concerned rates and the rest service. Of the rate complaints 104 were against electric power and light companies, as were 364 of the service complaints, 194 of the latter concerning installations, extensions and cancellations. The records of the gas and electric division show that of 943 complaints filed 648 were adjusted in favor of the consumers and 295 in favor of the utilities. The percentage of complaints per each 1,000 gas and electric consumers, taking the eighteen largest utilities, ranges from 0.25 to 6.07.

English Electrical Homes.—Seventy-three houses in course of construction at Billingham Village, Stockton-on-Tees, England, for employees of the North Tees central station, contain, in marked distinction from ordinary British practice, only two fireplaces each, one in the living room and one in the bedroom immediately above it. The rest of the house is to be warmed by portable electric heaters, which may also be used in the rooms containing fireplaces if the tenant prefers. Each fireless room is fitted with a ventilator. An electric cooker is installed in the scullery, and in the bathroom is placed an electrically heated clothes boiler. Each bedroom has a central electric light fixture and a wall plug to which a heater, flatiron or other appliance may be attached. Although the intention is to fill the clothes boiler with water from a central supply heated by the coal fire, electricity will be used to bring this water to the boiling point. Energy will be supplied at 250 volts, 40 cycles, single-phase, and a three-wire service is to be laid to each pair of houses. The estimated consumption of each house is from 3,480 kw.-hr. to 3,780 kw.-hr. a year.

Associations and Societies

A complete Directory of Electrical Associations is printed in the first issue of each month.

The American Washing Machine Association.—This organization plans to hold its annual convention and election of officers at the Sherman Hotel, Chicago, on Jan. 19-20.

A. I. E. E. and A. S. M. E.—The next joint meeting of the New York Section, A. I. E. E., and the Metropolitan Section, A. S. M. E., will be held on Jan. 28, when marine electrical engineering will be the subject. Alfred E. Waller will be in charge.

Wisconsin Contractor-Dealers.—The annual convention of the Wisconsin State Association of Electrical Contractors and Dealers will be held at the Republican Hotel, Milwaukee, on Jan. 19 and 20. A good program, including entertainment, has been prepared.

Boston Section, A. I. E. E.—Dr. Frank B. Jewett, chief engineer Western Electric Company, New York City, is announced to speak on "Wireless Telephony, Its Present Development and Future Possibilities," before the meeting of the Boston Section of the Institute on Tuesday, Jan. 11.

Iron and Steel Meetings.—"Relative Depreciation of Machinery" is to be the subject of an address before the Jan. 15 meeting of the Pittsburgh Section, A. I. and S. E. E., by L. F. Galbreath, West Penn Steel Company, Brackenridge, Pa. On the same date A. B. Clark, engineer with Sargent & Lundy, Chicago, will discuss "Efficient Electric Power Generation" before the Chicago Section.

Coming Meetings of Electrical and Other Technical Societies

American Association for the Advancement of Science—Chicago, Dec. 27-Jan. 1.

American Physical Society (annual meeting)—Chicago, Dec. 28-Jan. 1.

Association of Iron and Steel Electrical Engineers—Philadelphia Section, Jan. 8; Cleveland Section, Jan. 10; Chicago Section, Jan. 15; Pittsburgh Section, Jan. 15; Birmingham Section, Jan. 27.

American Institute of Electrical Engineers—Akron-Cleveland, Jan. 14; Portland (Ore.) Section, Jan. 10; Boston Section, Jan. 11; Pittsfield Section, Jan. 20; Chicago Section, Jan. 24.

Wisconsin State Association of Electrical Contractors and Dealers—Milwaukee, Jan. 19 and 20.

American Washing Machine Association—Chicago, Jan. 19 and 20.

American Society of Civil Engineers—New York, Jan. 19.

Western Association of Electrical Inspectors—Detroit, Jan. 25-27.

Association of Municipal Electrical Utilities of Ontario—Toronto, Jan. 27 and 28.

A. I. E. E. (New York Section) and A. S. M. E. (Metropolitan Section)—New York, Jan. 28.

A. I. E. E.—Midwinter convention, New York, Feb. 16-18.

Commission Rulings

Important decisions of various state bodies involving or affecting electric light and power utilities.

Powers of Arkansas Commission.—The Arkansas Corporation Commission has declared that it has jurisdiction to pass upon the reasonableness of rates, notwithstanding the existence of a contract between the utility and the town in which it is operating, and the fact that the Supreme Court of the state has held that a contract between a town and a public utility company is valid as between the parties does not deprive the commission of its jurisdiction to pass upon the reasonableness of the rates fixed in the contract.

Rates to Diking Districts Must Be Affected by Ability of Consumer to Pay.—In passing upon the reasonableness of an increase in contract rates for electrical energy furnished to diking districts, the Washington Public Service Commission took into consideration the fact that the diking districts are financially weak and that their expense budgets were based upon the cost of energy under the contract rate. An electric company, the commission held, cannot expect to derive a full return for energy employed in draining waste lands and developing new territory. The commission therefore refused to the North Coast Power Company permission to increase rates contained in a contract entered into by it after due deliberation and in reliance by the diking districts upon its continuance during the contract period—particularly where such contract was not entered into before the prevalence of war prices.

Municipal Plant Must Care for Subscribers Within Corporate Limits First.—According to a decision handed down by the Public Utilities Commission of Utah, the Hyrum City municipal electric plant must continue to furnish lighting service to its customers at the present rates, but may increase its rates for industrial power within and outside the city limits. The commission found that the plant was in good condition, and it therefore cut the proposed depreciation charge from 7½ to 5 per cent on the book value. It also pointed out that the interest on outstanding bonds, as well as the sinking fund for those bonds, must, under the law, be raised by the city's general fund and not from the plant itself. On adjusting the calculations of the municipal authorities on this basis it was found that the entire increase asked was not required. The commission remarked that a municipality owning and operating such a system should not contract to furnish power to industries and individuals outside its corporate limits to an extent that will render it unable to provide the necessary energy to meet the reasonable demands within its corporate limits, and that the users of lighting service should not be required to bear the burden of supplying power to commercial industries, one of the principal items of additional operating expense being the provision of essential break-down service.

Summer Service as Viewed by the California Commission.—There is a close analogy between water service and electric service at summer resorts. The problem of equitably distributing the cost of water service at such places and the fixing of reasonable rates has received the attention of the California Railroad Commission. In several cases the commission held that the few regular consumers of a utility serving a summer resort district should not be compelled to pay rates in excess of the value of the service which they actually receive, while the majority of the utility's consumers requiring service only during a few months of the year should be required to pay a rate which would embrace a readiness-to-serve charge covering the time when actual service is not rendered. In accordance with this principle the commission has in a few instances fixed a minimum annual payment which entitles consumers to service during four months of the summer season with additional monthly payments when water is required during the remainder of the year. These rates are so designed that the consumer using water only during the summer season pays a proper proportion of the total annual charges of the water system.

Extension of Service.—Complaint having been made of inequalities in the application of an order of the Public Utilities Commission of the District of Columbia relating to the extension of the service mains of the Potomac Electric Power Company, particularly with reference to the refund of deposits to consumers when additional applicants are connected to the extension for which deposits have been made, the commission has ordered that in cases where the lengths specified are not sufficient to reach the premises the company shall make the entire extension, provided the applicant or applicants deposit with the company $3.25 per linear foot for underground construction and 40 cents per foot for overhead construction for the length of the extension in excess of the free amount of extension per customer. This deposit will bear no interest but will be returned by the company to the depositor at the rate of $114 in the case of underground construction and $100 in the case of overhead construction for each additional customer served from the extension for which said deposit has been made, or from any further extension from and connected to the extension covered by the deposit, until the original principal amount of the deposit is returned, but in no event will the amount refunded exceed the amount of the original deposit.

Recent Court Decisions

Findings of higher courts in legal cases involving electric light, power and other public utility companies.

Public Utilities May Be Forced by Mandamus to Continue Service.—The Supreme Court of North Carolina has decreed that the Southern Power Company must continue to furnish electrical energy to the North Carolina Public Service Company at Greensboro and High Point, in spite of notice given by the Southern Power Company that this service would be discontinued on Jan. 1. The defendant company, appealing from a mandamus issued by a lower state court, declared that the suit was in fact one for a mandatory injunction and should be transferred to a federal court. This the Supreme Court denied, maintaining that the contention of the plaintiff that the Southern Power Company is under legal obligation to furnish it with electricity, defendant being a public service corporation engaged in that business, and its further contention that it is the duty of the defendant to continue this service after Jan. 1 and upon such reasonable terms as may be fixed by the Corporation Commission in the event that the parties cannot reach an agreement, made the issuance of a mandamus the proper remedy.

Public Service Commissions Law Does Not Oust Jurisdiction of Court.—There is nothing in the Public Service Commissions law of New York State, the Supreme Court of that state declared in Village of Warsaw vs. Pavillion Natural Gas Company, which in and of itself abrogates franchise provisions as to rates, although the Legislature has delegated that power to the Public Service Commissions, and until the commission concerned acts a public service company must comply with the provisions of its own contract embodied in a franchise, and to enforce compliance therewith a court has jurisdiction of an injunction. A proceeding before the commission to obtain authority to increase rates does not constitute an action for injunctive relief, and an order of the commission, if valid, does not become effective except by action in the Supreme Court. Hence the tendency of such a proceeding, assuming it to be an action within the meaning of the statute, could not be set up as a ground of demurrer in an action against the gas company to enjoin it from violating its contract included in a franchise fixing rates. (184 N. Y. S. 327.)*

*The left-hand numbers refer to the volume and the right-hand numbers to the page of the National Reporter System.

Men of the Industry

Changes in Personnel and Position—Biographical Notes

W. J. Santmyer, for twenty-one years connected with the Puget Sound Traction, Light & Power Company, Seattle, Wash., as superintendent of steam and advisory engineer, has become president of the Power Plant Engineering Company of Seattle, which has recently been incorporated. Mr. Santmyer will retain his position with the Puget Sound company. He is inventor of the Santmyer powdered-coal burner and feeder.

A. G. Wishon, who has been identified with hydro-electric development in the High Sierras since 1894 and general manager of the San Joaquin Light & Power Corporation, Fresno, Cal., since its organization in 1903, was recently

A. G. WISHON

elected vice-president and managing director of that company. The election of Mr. Wishon to the position of vice-president was celebrated by a luncheon of the executives and department heads of the company. A biographical note on Mr. Wishon appeared in the ELECTRICAL WORLD for Aug. 21, 1920, pages 368 and 402.

John D. Kuster, for several years manager for Santa Clara County of the Pacific Gas & Electric Company of San Francisco, has been promoted to the position of manager of the entire San José division, which includes the territory from south San Francisco to the southern end of Santa Clara County. Mr. Kuster has been active in association affairs on the Pacific Coast.

Arthur R. Wellwood has recently become identified with the engineering staff of the Super-Power Survey, with offices at 709 Sixth Avenue, New York City. Mr. Wellwood, who has a wide experience in construction, operating and engineering work, was formerly associated with the Central Hudson Gas & Electric properties, his last post being that of district operating manager, where his duties covered plant production, transmission and distribution and all construction work in the territory. He received his technical education at New York University and has spent most of the years since his graduation in the utility field. He served overseas with the combat engineer troops.

James R. Cravath, heretofore a member of the firm of Fowle & Cravath, consulting engineers of Chicago, has found it necessary to terminate his connection with that firm and move to California owing to the ill health of one of the members of his family.

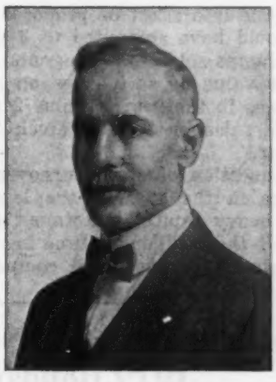
H. M. Gansman, formerly manager of the supply division, Philadelphia district office of the Westinghouse Electric & Manufacturing Company, has resigned to become general manager of the H. C. Roberts Electrical Supply Company, Philadelphia.

H. F. Brinckerhoff, who has been in charge of the Bluefield and Charleston (W. Va.) offices of the Westinghouse Electric & Manufacturing Company, has been appointed manager of the supply division of the Philadelphia district office of that company.

Frank F. Fowle, a member of the firm of Fowle & Cravath, consulting electrical and mechanical engineers of Chicago, has formed a new consulting firm, known as Frank F. Fowle & Company, owing to the discontinuance of the partnership of Fowle & Cravath on account of the ill health of one of the members of Mr. Cravath's family, which has forced him to move to California. The advisory services of Mr. Cravath in illuminating engineering will still be available, and he has retained a connection with the new firm for that purpose.

A. W. K. Billings of Barcelona, Spain, is visiting this country on a business trip. Since 1912 Mr. Billings has been closely identified with extensive hydro-electric work at Barcelona as manager of construction, managing director, vice-president and consulting engineer of the Ebro Irrigation & Power Company, Ltd. During the war he was in charge of naval aviation construction in Europe and was promoted to the rank of major. For distinguished services in this work he was enrolled in the Legion of Honor and received the navy cross. Prior to his work in Spain and elsewhere for the Pearson interests, Mr. Billings spent two years in Pittsburgh and ten years in Cuba on power-plant construction and two years in New York as engineering manager of J. G. White & Company, Inc. In 1917, before entering the United States army, Mr. Billings maintained a consulting office at 115 Broadway, New York City. His address while in the United States will be the Engineers' Club, New York.

Gordon Campbell, president and general manager of the Edison Light & Power Company, York, Pa., and also of the York Railways Company, who was appointed vice-president of the Municipal Service Company, Philadelphia, and moved from York to Philadelphia in the latter part of 1919, has recently moved back to York. This move has been found necessary in order that he may devote all of his attention to the York electric light and railway properties. Mr. Campbell became identified with the York properties in 1908. Before that he was associated with public utilities in Denver, Col.; Newark, N. J.; Providence, R. I., and Washington, D. C. Mr. Campbell has devoted a great deal of



G. CAMPBELL

his time to association matters in recent years and has served as a member of the executive committee and as vice-president and president of the Pennsylvania Street Railway Association.

R. S. Whaley, formerly manager of the Rainier Heat & Power Company, Seattle, Wash., has become vice-president and manager of the Power Plant Engineering Company, Seattle, Wash., which company has recently been incorporated to design and install power-plant equipment.

Obituary

John T. Chambers, chief engineer of steam-power plants of the Georgia Railway & Power Company, died suddenly on Sunday, Dec. 12. Mr. Chambers was fifty-two years of age and had been associated with the Georgia Railway & Power Company for twenty-nine years. He was first employed as an oiler and had served in almost every position in the steam stations, being promoted to the position of chief engineer upon the retirement of Mr. Bluxham several years ago. Mr. Chambers was a prominent figure in central-station activities throughout the South.

Trade and Market Conditions

News of the Trade for the Manufacturer, Wholesaler and Jobber of Electrical Equipment and Supplies—Notes on Industrial Activities and Business Methods

Present Lamp Turnover Policy to Hold in 1921

LAMP manufacturers have decided to pay as additional compensation the full 5 per cent on the list value of B agents' sales from stock in the coming year. This is merely a continuance of the policy which they put into effect last winter but which they had expected to change for the year 1921 into one which would place a premium on a total stock turnover of six times in a year. Had the rider gone into effect as proposed the additional compensation would have amounted to 3 per cent on the list value of the lamps sold from B agents' stocks plus 1 per cent on the list value of such sales on a total stock turnover of five times in the year, or plus 2 per cent on the list value of such sales on a total stock turnover of six times in the year.

The question of stock turnover is still one of vital importance in the eyes of the lamp manufacturer because of his heavy capital investment in distributed stocks, and it is felt that still more time is needed in which to gather data relative to additional compensation and turnover.

Appliance Sales in Northwest Below 1919 Holiday Volume

ELECTRICAL jobbers and dealers in the Northwest, as a whole, are of the opinion that this year's holiday appliance sales volume will be light—that it will show a considerable dropping off as compared with the volume at this time for several years past. Their opinions are predicated on several more or less obvious reasons. For instance, Seattle and the Puget Sound section, not unlike other sections of the country, are still wallowing in the trough of the so-called reconstruction period. Generally speaking, industry and business are quiet. The mills and logging camps are either closed down or are running close-reefed because of the high cost of manufacture in the face of a falling market. The shipyards in this district, from all appearances, are "through"—at least for the time being. There is a surplus of labor, both skilled and unskilled, and the number of unemployed is being daily augmented by release of men from the logging camps, mills, factories, machine shops, boiler works and like institutions.

The above facts, in connection with an imminent cut in wages, have tended to discourage buying at Christmas time which might be construed as non-essential. It is conceded that electrical domestic appliances are practical, efficient and much to be desired and also that they do not come under the head of luxuries. However, by the rank and file of wage earners, men who live from a monthly or weekly salary, these same appliances are not considered essentials. Therefore they will not buy them in the face of their own uncertain financial condition. The prevailing opinion that prices of electrical merchandise are high, considering recessions made in other lines, is another deterrent factor.

Jobbers and dealers in the smaller towns and rural communities especially have been conducting sales campaigns on electrical appliances with fair results. Reports from several different sections in this district state that washing machines, vacuum cleaners and socket-device heaters are moving very satisfactorily. Ironing machines also, while new or comparatively so in this territory, are showing a good movement considering their price. With but few exceptions, the small-town dealers report that they have no particular trouble in obtaining sufficient stocks to meet their demands and that replacements come through well.

Oregon stocks of heating appliances in general are in good condition, both with the jobbers and with the dealers. Some lines of hollow ware, such as percolators, toasters, etc., are scarce, however, and will be off the market before the holiday season is over. Stocks of waffle irons are entirely depleted in some instances. Supplies of electric irons are in satisfactory shape and should be ample for the holiday trade. The demand for heating appliances is increasing appreciably, but is not what it was a year ago.

Tape Producers Look for Good Year Ahead

DESPITE recent declines in tape purchases manufacturers of both friction and compound tape will undoubtedly close the year with a large gain in total business handled over 1919. Deliveries are now easy as in many other lines. An optimistic tone pervades the market with regard to next year's sales, even though inquiries and orders are at present running low. It is felt that the necessities of the coming year will require the placing of substantial orders during the course of the twelvemonth period. Some of these commitments may be small and others large, but in the opinion of leading sales executives little reason for pessimism exists.

Some reduction in prices is expected about Jan. 1, but it is hard to see how this can exceed 10 per cent in view of the continuing high cost of labor, fuel, transportation, whiting, surphur and some other material. Sharp as have been reductions in cotton cost, these have been insufficient seriously to affect the manufacturing expense in friction-tape and rubber-tape production. Overhead costs continue at high levels and taxation burdens show small signs of material lightening. The outlook for immediate business is somewhat uncertain, but it is believed in manufacturing circles that easier prices will stimulate orders somewhat and that as soon as buyers realize the relations of various cost factors to current quotations better trade will be enjoyed.

Raw-Pipe Quotations Only Steel Price to Remain Up

OF THE steel products the price of which the independent mills were keeping any distance above that of the United States Steel Corporation, pipe alone is said to remain. Merchant pipe, on the supply of which electrical rigid conduit depends, is enjoying an excellent demand, and the independent mills are still able to maintain their list prices about $7 a ton over the corporation list.

Demand for rigid conduit in the electrical trade is not very strong. Although it is the product of which supply jobbers have experienced the most difficulty in acquiring any kind of a stock, especially in the ½-in. size, producing mills have had to curtail their output probably to the extent of 20 or 25 per cent in order to keep their production down on a level commensurate with the slackened demand. This demand in the last few months, however, has not been steadily decreasing, but has fluctuated up and down in keeping with changing activity, each valley being lower than its successor, so that the entire trend has been downward.

Demand on steel and iron tube products is still very strong, and no indication of a let-down is seen in the near future. So long as this is so, just so long will the tonnage allotted for rigid conduit be relatively small. Manufacturers' sales of conduit in the past year would undoubtedly have been larger had more raw stock been available, but at the same time jobbers would have had bigger stocks than they have now. As it was, a great deal of shopping around was necessary to fill orders, and generally depleted stocks resulted; but it is doubtful whether any real amount of construction was held up because there was no pipe to be had.

Considering the demand still existing in the raw-pipe market it can hardly be expected that prices will go down to any extent in the near future, even for rigid conduit.

Advances in Washing-Machine Costs in Three Years

INASMUCH as so much is heard of the advances which have taken place in the price of washing machines in the last three years it may not be amiss to reproduce some figures just received from the American Washing Machine Manufacturers' Association. This association realizes, however, that list prices of washing machines have not followed the manufacturing costs in proper proportion and

AVERAGES OF PERCENTAGES OF INCREASE SINCE SEPTEMBER, 1917

Item	Per Cent	Item	Per Cent
Labor	106	Lumber	117
Motors	39	Cypress	201
Wringers	76	Cypress tubs	140
Cut gears or worms	68	Maple	144
Copper sheeting	21	Cedar	94
Castings	111	Gum	164
Malleables	95	Crating	118
Galvanized sheet steel	80	Cut stock	201
Angle iron	92	Paint	81
Flat steel	104	Freight—inbound	77
Casters	66	Freight—outbound	79
Fittings	65		

that with the hoped-for decline in prices there is a great deal of slack that must be taken up before list prices can be reduced.

The accompanying table shows the averages of percentages of increase since September, 1917, for the various items entering into the manufacturing cost of a washing machine. The average increase in list prices of the finished machine is given as 59.6 per cent.

Electric Truck Industry Is Growing Rapidly

MANUFACTURERS of electric trucks almost without exception are enthusiastic regarding the possibilities for business that are developing in line with the increase in transportation by electric vehicles throughout the country. One of the leading makers reports the best sales of electric trucks this year in the history of the business, and this statement finds an echo with several others. A reliable estimate of the number of electric trucks sold in this country during 1920 places the total at about 5,000, with an estimated value of $22,000,000. Of this number about 600 are accounted for by the metropolitan district of New York City alone, proving the latter to be the largest single market for vehicles of this type at present.

There are approximately 5,000 electric trucks in use in the latter district at present, representing about 10 per cent of the total. Within ten years, it is stated, the number of electric trucks in use in the city will from present indications surpass the gasoline-driven vehicles. In line with the excellent prospects for sales that are seen next year at least two of the large manufacturers are increasing their production facilities sufficient to allow an annual output of 1,500 trucks each.

Production conditions with respect to labor and raw material are favorable, so that deliveries in general can be made within five to eight weeks. No trouble is experienced in obtaining motors, it is stated, while truck batteries can be supplied in two or three weeks. The supply of batteries of this type incidentally is plentiful, as production has not been affected by the falling off in demand for starting and lighting sets on behalf of pleasure cars. Prices of trucks have undergone no change, and manufacturers state that price reductions are out of the question for the immediate future.

An interesting sidelight on the electric truck industry is the campaign of education which is being carried out by manufacturers. One of the latter recently sent out a questionnaire to users of commercial trucks asking their attitude toward the electric vehicle. Replies from non-users of these trucks indicate that ignorance is the chief obstacle to their wider use. Within the past twelve years, this company reports, 85 per cent of its sales have resulted in repeat orders.

Metal Market Situation

IN CONTRAST with last week's condition of comparative stability in the copper market this week shows recessions below the price of 14 cents on the part even of some producers. These are offering metal at 13.75 cents for delivery over the remainder of the year, but the run of large producers in general will not shade the price of 14 cents. In the outside market there is a small amount of copper for sale as low as 13.50 cents f.o.b. refinery for prompt and December delivery, but the amount is limited. For first-quarter use the seconds have little copper, and that is holding at 13.75 cents. Producers are holding 14 cents as a ruling price for early 1921 copper.

There is little buying of the red metal. Domestic consumers are operating at greatly reduced capacity, and brass mills are not buying at anything like their accustomed level. Mines in Butte are reported to have posted notices announcing a shutdown as the alternative to the reduction of wages, this decision to take effect Jan. 2.

The American Smelting & Refining Company, which has for many years marketed along with its own copper the copper of other companies whose product is treated in its refineries, announces that this practice will be discontinued and that hereafter it will sell only its own copper, just as it has heretofore sold only its own lead, spelter, tin, silver, gold and other metals.

As a consequence the Utah Copper Company, the Ray Consolidated Copper Company, the Chino Copper Company, the Nevada Consolidated Copper Company, the Chile Copper Company, the Kennecott Copper Corporation and the Braden Copper Company, whose product in the past has been sold through the American Smelting & Refining Company, will have as their selling agent after Jan. 1 the firm of Guggenheim Brothers.

Lead continues inactive, although inquiries for delivery for the first few months of 1921 have increased. There is little disposition, however, to quote for these futures. The official Eastern price is 5 cents, but the outside market is 4.60 to 4.70 cents for prompt and December.

NEW YORK METAL MARKET PRICES

	—December 13—	—December 20—
Copper	£ s d	£ s d
London, standard spot	76 15 0	74 0 0
	Cents per Pound	Cents per Pound
Prime Lake	Nominal 14.25	Nominal 14.00
Electrolytic	14.00	14.00
Casting	13.25	13.12½
Wire base	17.00	16.00–16.50
Lead, trust price	5.00	5.00
Antimony	5.50	5.50
Nickel, ingot	43.00	43.00
Sheet zinc, f.o.b. smelter	11.50	11.50
Zinc, spot	6.40–6.50	6.25–6.35
Tin	33.75	34.00
Aluminum, 98 to 99 per cent	32.90	32.90

OLD METALS

	Cents per Pound	Cents per Pound
Heavy copper and wire	11.00–11.50	11.00–11.50
Brass, heavy	6.00– 6.50	6.00– 6.50
Brass, light	4.50– 5.00	4.50– 5.00
Lead, heavy	4.00– 4.50	4.00– 4.25
Zinc, old scrap	3.50– 3.75	3.50– 3.75

THE WEEK
IN TRADE

WITH the assistance of a holiday demand jobbers and dealers are still doing business. There is a constant amount of additional wiring required for lighting and power circuits, but not a heavy demand for motors and other apparatus. Stocks of motors are better and deliveries quicker. Jobbers are not augmenting any of their stocks just before inventory period, but are pushing sales in an endeavor to lower them. They are meeting with more or less success, depending on the effort. Building is quiet.

It seems to be no harder to make collections than it has been, but conditions in the money market will permit of no let-down in the energy required in following accounts.

Prices quoted below are those holding at the opening of business on Monday morning last.

NEW YORK

Little or no charge is evident in trade conditions here, quietness being still the prevailing feature of the industry. Jobbers apparently expect no increase in demand for some time to come and are concentrating their efforts upon sales of various small items which have a fair movement. This is meeting with some success, for though sales of staple articles, such as wire, loom, tape, cords, cable, etc., are at a minimum, there is enough of the so-called "fill-in" variety of goods sold to total a fair volume of business with many houses.

Stocks are being gone over carefully with the end of the year at hand, and jobbers are holding their inventories down as low as possible. The policy of interchanging stocks is aiding in this respect. Collections show no change but must be pushed hard and closely to being results. A feature of the price situation is the wide range shown in the quotations of jobbers on most items, indicating the variance of such conditions as demand, pressure to liquidate, condition of stocks, etc.

Reports on the volume of business done by dealers at present vary considerably, but from all accounts the Christmas trade will not show so large a total as in past years.

Rubber-Covered Wire.—The situation remains unchanged, with stocks too large on the whole for the present weak condition of this market. No. 14 in quantities of 10,000 ft. is quoted at prices ranging from $8.50 to $9.50.

Tape.—Though some jobbers are making fairly good sales to industrials, general tape demand is off and the supply is plentiful. In 100-lb. lots friction tape ranges from 46 cents to 55 cents per pound, and rubber from 45 cents to 50 cents per pound.

Non-Metallic Flexible Conduit.—Demand is poor both with manufacturers and jobbers. Stocks are well filled. In quantities of 1,000 ft., $\frac{7}{32}$-in. brings from $3.25 to $4.50 per 100 ft., and $\frac{1}{4}$-in. from $3.50 to $4.50 per 100 ft.

Lamp Cord.—Almost no demand exists in this territory and stocks are too large. In 500-ft. quantities from $19.50 to $28.50 per 1,000 ft. is asked for No. 18 twisted.

Porcelain.—Demand has fallen off to such an extent that jobbers' shelves are fairly well stocked except for 3-in. tubes. In barrel lots 3-in. tubes are worth from $11 to $16.50 per 1,000, two-wire unglazed cleats from $21 to $23.50 per 1,000 and "Nail-it" knobs $32 per 1,000, net.

Outlet Boxes.—Demand is reported very slow with stocks well filled. In quantities of 100 the discount quoted by jobbers on black ranges from 23 to 30 per cent and on galvanized from 15 to 25 per cent.

Flashlights.—Demand on behalf of the temporary Christmas trade is reported as considerable, and sales of separate batteries and cases are good too. The supply is plentiful with no change in prices.

Safety Switches.—Althougn some jobbers are making good sales, the general demand is light owing to lack of building work. Stocks, while not large, are considered adequate. Prices remain steady.

CHICAGO

Christmas sales, in point of number, are about up to last year's figure, but the average value and resultant total in money is much less. In the field of household appliances trade is inclining to the lower-priced items. Dealers are watching reduction of their stocks complacently, showing but little disposition to refill their shelves. The general disposition is to permit inventories to get as low as possible. The jobber and the manufacturer are feeling this in the reduced number of orders being booked. Reduced output on the part of manufacturers of nearly all lines to protect their own finished-stock inventory is the order of the day.

Credits are being very closely scanned. Collections range around sixty days, which is not so good as the same figure a month ago, for the gross amount outstanding is getting lower and energy expended in collecting is increased. It is generally felt that by the middle of January a definite trend toward normal business will have been established.

Wire—Prices fluctuate badly. The quotation on bare copper wire, No. 8, in 1,000-lb. lots, is 18½ cents. Weatherproof in similar quantities is, for the No. 6 triple-braided, 23 cents per lb., and for the No. 8, 23½ cents. Demand is light, material for maintenance purposes only being bought.

Poles—As is usual at this time, a minimum of shipments is being made. Producers are active in accumulating stock in the woods and in many cases are operating at lower labor cost than last year. With the price of all lumber products reduced nearly 50 per cent, it is reasonable to look for cheaper pole quotations before spring business opens up. Transportation cost will remain high.

Insulators.—This is the one item in which a definite shortage still exists. Production is not yet able to supply current demands on glass, and back orders are being carried in large volume. Prices are firm. Porcelain stock remains almost unobtainable. Deliveries on small sizes of porcelain line insulators are upward of four months in arrears, and the heavy-strain types are in much worse shape. No real relief from this condition seems in sight.

Locust Pins.—These are in plentiful supply. Slight price revisions have been made, downward on the larger sizes and upward on the small size, the net result being to leave the line practically unchanged. This is another item which it seems that lower costs in the wood production field should affect.

Heating Appliances—Total retail sales in the various items of this line are good, but dealers are showing no desire to replenish stocks. Curtailed output is reported by most manufacturers. At least two manufacturers have issued advanced price lists on scattered items, the result being an immediate decrease in sales.

Household Appliances.—Sales at retail in comparison with lower-priced electrical goods are light. Manufacturers report but few orders from jobbers. Sewing-machine sales are particularly light, and one maker has made a special price concession for a limited time. Demand for guaranteed prices is widespread and insistent. Washing-machine sales are good.

BOSTON

Business continues in moderate volume. In some quarters a better feeling is reported, although it has not yet been reflected in much new buying. Most jobbers will be occupied into the new year filling back orders. Prices are holding steady for the most part. Collections are slow, but some improvement is mentioned in central-station settlements. In some of the so-called "one-industry" towns where local manufacturing plants are shut down or running on short time contractor-dealers are finding it hard to obtain money

to pay for goods received from the jobbers. Emphasis upon the underlying soundness of the electrical industry is widely prevalent in discussions of trade conditions. Building operations are not keeping up to earlier records of increase over last year, though the total for 1920 will probably exceed the 1919 figures considerably for New England as a whole. Very cautious buying is the policy in the wholesale field, but with the turn of the year a better outlook is anticipated.

Appliances.—Jobbers do not appear to be overstocked in the lighter lines. The retail trade is showing excellent results. One large house surpassed last year's November sales and turned over a healthy output for early December.

Schedule Material.—Ample supplies of switches and sockets are on hand. Prices are firm and the demand is moderate. Until building picks up stocks are not likely to be drawn down rapidly enough to cause shortages.

Wire.—Recent declines in price do not appear to have stimulated the demand, although a routine volume of sales of rubber-covered and weatherproof is being booked. In 1,000-ft. lots No. 14 rubber-covered is quoted at $9, and the weatherproof base continues steady at 23 cents.

Motors.—Boston stocks are spotty as to smaller sizes of integral ratings. The lull in demand gives more time for considering motor applications from the engineering standpoint, and local distributers are fairly busy with proposition work. Manufacturers still have several months' orders on hand in some cases. Second-hand stocks appear to be increasing in size.

Portables.—Heavy stocks of portables are evident in the retail trade, and some doubt exists as to price stability after Christmas. Price cutting has not attained the proportions one might expect. Plenty of lamps are reported on hand for the holiday trade, and with the coming of longer days, the fear of a shortage this winter appears groundless.

Rigid Conduit.—Current requirements can now be met with little difficulty. On 1-in. pipe prices range from 18 to 19 cents per foot, and on ½-in. pipe from about 9 cents to 10 cents, in large quantities. It has been some time since shortages of fittings have been general.

Radiant Heaters.—Unusually mild winter weather has helped the sale of these devices. Prices are steady, with fair stocks.

Flexible Armored Conductor.—Quiet sales rule, with firm prices. No. 14 single-strip sells at $85 in 1,000-ft. lots. Some of this material of smaller size is being used in exposed wiring for public telephone stations.

ATLANTA

It is felt that the Foreign Trade Financing Corporation, which was recently formed, will aid much in financing exports of agricultural products and stimulating the movement of crops, and this will undoubtedly be reflected by better business conditions throughout the section. Building activities continue to slump and little or no construction of moment is reported this month, though repairs and improvements are being undertaken. The opinion is freely expressed, however, that the slump in the price of building material will stimulate building and that activities in this line will be resumed on a nearly normal basis by early spring. The Master Builder's Association at its last meeting adopted a new wage scale for the coming year. This is considerably below the present scale but still approximates an increase of 100 per cent over the wage paid in 1916. Undoubtedly considerable opposition will be met in putting this scale into effect. All lines of business report collections very slow. There is a fair amount of activity reported in the Christmas goods line, though the tendency of the public is to hold off buying until after the first of the year.

Pole-Line Hardware.—Slow movement and heavy stocks are responsible for a 15 per cent reduction in price just announced. Some jobbers predict that this reduction will soon be reflected in the price of other steel products.

Armored Conductor.—All jobbers report heavy stocks on hand, and orders are coming in, but slowly. Some of the smaller jobbers are heavily stocked, and there are isolated instances of this material being unloaded at $85 per 1,000 ft. in two-wire No. 14 sizes. The larger jobbers are holding the price steady at $95.

Conduit.—Conduit continues to move fairly satisfactorily, one or two firms reporting their stocks somewhat spotty, though in most cases ample supplies are on hand.

Metal Molding.—Repair work has served to stimulate the movement of this specialty, jobbers reporting it moving more actively than for some months past. Stocks and shipments are reported fairly satisfactory.

Christmas-Tree Outfits.—An unusual demand is reported, the stock of one of the largest jobbers having been completely exhausted. The eight-light and sixteen-light sizes appear to constitute the fastest moving stocks. Retail prices, eight light, $5.50; sixteen lights, $11.

Domestic Heaters.—The high price of fuel has served to create and sustain an excellent demand in this line. In fact, present indications are that this season will be a record breaker. Good shipments have enabled jobbers to hold up their stocks fairly well. Retail prices, single heaters, $12; double heaters, $15.

Mangles.—Heavy sales of washing machines have in turn awakened an interest in mangles. One of the large jobbers is expecting a good movement after the first of the year.

ST. LOUIS

There has been little change in conditions in the past week, sales of staple supplies remaining low and the demands of the holiday trade partly making up for this inactivity. Dealers and department stores report that retail buying picked up considerably during the week, and jobbers felt the effect of this in a satisfactory number of orders for heating appliances and hollow ware. They have been able to supply this demand, with the exception of percolators, on which they are unable to get delivery. Prices are holding firm except on wire. A few small houses are making concessions on other lines because of a need for cash, but this is not widespread enough to hurt the market to any extent.

Wire.—Quotations are nominally on the 23-cent base, but there are numerous cases of sales being made on a base as low as 19 cents for both rubber-covered and weatherproof and as low as 20 cents for magnet wire. Jobbers continue to carry heavy stocks of rubber-covered and weatherproof, but their stocks of magnet wire are not overlarge. There is very little demand.

Sockets.—Jobbers have more than enough to take care of a fairly steady demand. Lighting installations and additions are becoming more frequent in homes, plants and office buildings with the increase in the hours of darkness, and this is keeping the demand fairly strong. Pull sockets are quoted at 51 cents, key sockets at 28¾ cents and keyless at 25 cents.

Non-Metallic Flexible Conduit.—Jobbers have stocks slightly over normal and are finding their interchange agreement useful. Demand is fair; $33 per 1,000 ft. in 5,000-ft. lots is a representative quotation for the ⅜-in. size.

Tape.—Demand has shown a slight increase, but jobbers have supplies large enough to take care of it. Both friction and rubber tape are quoted at 47 to 50 cents per pound.

Fixtures.—Fixture manufacturers and jobbers report that sales of the staple lines of fixtures have fallen off greatly but that this has been made up by the increase in demand for special work. Many buildings started last summer are reaching the stage where lighting fixtures may be installed. A slight slump is looked for in the early part of 1921 when this work has been completed.

Lamp Cord.—Jobbers have large stocks and demand is remaining steady though below normal. The silk cord is not in as large supply as the cotton-covered. No. 18 twisted pair cotton-covered is quoted at $16.75 per 1,000 ft. and silk-covered at $21 per 1,000 ft.

Lamps.—Stocks of lamps are good though not entirely complete. Demand is growing steadily as the winter sea-

son advances, though it is not expected to be as heavy as that of last year.

Fuse Plugs.—Demand is remaining normal and stocks are ample to take care of it.

SAN FRANCISCO

Compared with conditions of December, 1919, this year records a very marked difference. Last year stocks were practically non-existent and there was an early Christmas shopping season, whereas this year there are not only big stocks of both wiring and counter material but the buying public is holding off to an unprecedentedly late hour. Collections are more than holding their own because tighter conditions have produced more vigilance on the part of credit managers, so that the general average of collections is still well below fifty days. New credits are being cautiously extended, especially in districts where crops have been affected by weather conditions or other local causes. Credit managers state that they are receiving very few applications for credit from new firms. There has been a noteworthy effort by California power companies to market their bonds, especially among the electrical fraternity. For years lack of sufficient money has hampered the extension of much-needed electrical power, but it seems as though the answer has been found in widespread public subscription.

Motors.—For the first time in several years factory deliveries of motors are more than keeping pace with the local demand. The deliveries of sizes larger than 10 hp. are particularly good. After years of shortage there are plenty of single-phase motors in the smaller horsepowers. However, deliveries of two-phase and three-phase motors in the 5-hp. size are still slow.

Lamps.—Lamp stocks are very good and jobbers are able to keep their stocks down to an average of a forty-five-day basis. Dealers' stocks have been carefully edited, with the result that they are not topheavy in certain sizes and are well assorted.

Conduit.—Building operations have dropped off, and there are accumulated stocks on the Pacific Coast. These are not serious, because building is urgently needed, whatever its cost.

Vacuum Cleaners.—Dealers are stocking a variety of makes, which has resulted in good factory sales for nearly all manufacturers. Prices have been steady with little likelihood of any startling recessions. Christmas sales have been disappointingly low.

Wire.—Rubber-covered wire stocks are good, although in some of the larger sizes jobbers report considerable accumulations.

Schedule Material.—While the housing situation is desperate, it is felt that there must be plenty of building to meet the situation. There are large construction plans for the near future, and in fact it is estimated that there is $10,000,000 worth of bank buildings alone laid out for the San Francisco Bay region. Schedule material is beginning to accumulate in the jobbers' stocks because of better factory deliveries and a marked return to hand-to-mouth buying by contractors. Snap switches in small sizes are moving well after several years of comparatively low sales in comparison with push switches.

SEATTLE—PORTLAND

Business in Seattle and the Puget Sound territory during the past week showed no improvement worth mentioning. Both jobbers and dealers state that without a doubt this year's Christmas business has been the poorest in years. Stocks, generally speaking, are a trifle heavier than necessary because of the increasing unwillingness on the part of the public to buy. Building, in Seattle particularly, has virtually stopped, but some authorities believe it will revive around inauguration time. Contractor-dealers and small dealers are being hard hit.

Portland district reports business rather slow; in fact, business conditions throughout Oregon, especially in the smaller towns, indicate a marked slump in trade. There seems to be a general feeling of depression, and the talk is mainly of exceptionally poor business for the next few months. The principal reason for this condition seems to be that farmers are holding their wheat and fruit waiting for higher prices, thereby tying up money that should be in circulation. Moreover, increases in freight rates have seriously interfered with lumber shipments East and have resulted in shutting down many mills. The wool market also is in very poor condition. The situation in regard to three of the leading industries of the section has affected business conditions very seriously, and the result is becoming more apparent each week. The credit situation is in poor condition and collections are kept up to present standards only by persistent effort. All over the Northwest there is a considerable amount of idle labor. Contractors in this territory state that business is quieting down appreciably, with the future not particularly bright.

Farm-Lighting Plants.—From all over the Northwest come reports that these plants are not moving as well as expected. In nearly every locality stocks are in good shape and replacements are easy to make. In an effort to improve sales jobbers are guaranteeing prices on plants for six months so that the dealer and purchaser will be protected.

Hollow Ware.—Stocks are short and will undoubtedly be exhausted when Christmas sales are completed. In fact, an extreme shortage in percolators, toaster stoves, etc., is apparent at present. Stocks of electric irons are in good shape and the movement is satisfactory.

Fractional Motors.—Stocks are improving very fast and demand is light.

Rubber-Covered Wire.—During the last five weeks prices have dropped 25 per cent and the tendency is still downward. Demand is exceptionally light and stocks are becoming well filled.

SALT LAKE CITY—DENVER

One of the most hopeful signs of this stressful business era is the co-operative effort bankers are putting forth to prevent excessive liquidation on the part of dealers and jobbers. They are showing a disposition to extend time on paper to the point of extreme leniency, realizing that stringent measures would bring about a general condition of business demoralization. The Western Branch of the Federal Reserve Bank is right back of all its client institutions in this constructive movement. Electrical dealers are making vigorous appeals in their holiday advertising and seeing to it that electrical merchandise is not overlooked in the selection of gifts. Useful lines are being especially featured, eleventh-hour Christmas shopping has shown a gratifying increase in rural districts, and the response is particularly good. Farmers have recently received substantial checks for their beet crop and are showing no tendency to hoard. Business has experienced a noticeable pickup in rural districts.

Radiant Heaters.—A price range from $12.50 to $14 is being advertised. The season for good selling is past and the demand is off. Dealers are pretty well cleaned up on stocks.

Percolators.—This line is in especial favor as gifts and they are reported going well in most sections. Dealers are well stocked, and prices run from $12.50 to $29.50.

Waffle Irons.—The demand is rather light; the average price is quoted around $20.

Curling Irons.—There is not much call for these except among well-to-do persons; a range of price is from $7 to $8.

Chafing Dishes.—These are perhaps the most popular in the hollow-ware line, especially with Christmas shoppers, and sales are good.

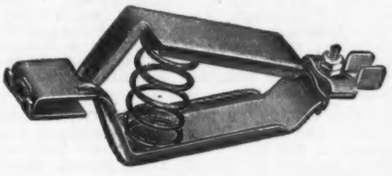
Washers and Cleaners.—While dealers generally have been driving hard on these two lines in all their selling efforts the response has not been satisfactory. Buyers still hesitate over investments involving any considerable outlay of money. There is a decided disposition to wait and watch for developments.

NEW APPARATUS & APPLIANCES

A Record of Latest Developments
and Improvements in Manufacturers' Products
Used in the Electrical Field

Clip Connector for Large Capacity

A spring clip has been placed on the market by the Mueller Electric Company, Cleveland, Ohio, for testing



CARRIES 500 AMP. WITHOUT OVERHEATING OF JOINT

motors, transformers, etc., requiring up to 400 amp. or 500 amp. The clip is made of copper containing sufficient alloy to give the necessary stiffening effect when combined with the reinforcing flanges on the sides. There are no teeth in the jaws, but a sort of hair-lip effect is used to hold the clip onto a stud or terminal. The opening of the jaws is sufficient to take a 2-in. boiler pipe, and the pressure exerted by the spring is about 50 lb. A copper connection shunts the hinged joint. This keeps heavy currents away from the spring and prevents its overheating.

Portable Phase-Sequence Indicator

To enable phase sequence to be determined easily the States Company, Hartford, Conn., is placing on the market a light and compact indicating device. It is so designed that when the phases of a circuit are connected to the binding posts a pilot lamp set into

LAMP INDICATES DIRECTION OF PHASE ROTATION

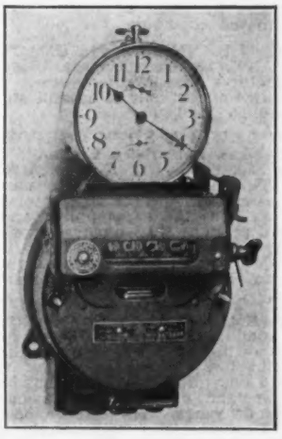
a recess in the case indicates by its brightness or dimness the direction of phase rotation. A push-button in the case reverses two of the leads and provides the contrasting indications of the lamp by modifying the magnetic-flux resultant of the interior coil windings. The device has no moving parts and weighs less than 3 lb.

Cigar Lighter

The midget-type cigar lighter developed by the Duralectric Corporation, Jamestown, N. Y., for home use is finished in mahogany and consumes about 20 watts. This type is built for 110-115 volts and 60 cycles.

Meter-Reading Device

For use on watt-hour and polyphase meters the Economy Appliance Company, Waterloo, Iowa, is manufacturing a meter reading and recording device. A clock is provided for operating the device at any specified time for recording the meter reading on a card especially made for that purpose.



RECORDS READING AT SPECIFIED TIME

Watchman's Clock System

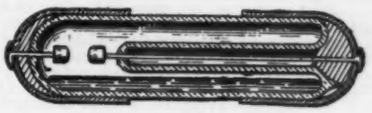
The E. Howard Clock Company, Boston, Mass., has developed a watchman's clock system requiring but two wires per circuit, with an indefinite number of boxes on a circuit connected in multiple, each making its own distinctive number record. The station number and time of recording are shown as a perforated record in a paper dial.

Automobile Test Set

The F. B. test set, manufactured by the F. B. Electric & Manufacturing Co., Detroit, Mich., consists of three ammeters and three voltmeters specially designed for use in making, with apparatus in place, necessary tests to determine starting and lighting troubles. Instruments are contained in one case, with which go two sets of cables. Zero center correction may be applied, and a special scale is shown in different colors and special markings for making cadmium tests.

Mercury Contactor Fits Fuse Clips

The Absolute Con-Tac-Tor Company, 127 North Dearborn Street, Chicago, placed on the market a hermetically sealed circuit-breaking device which can be used as a switch or to make and break an electric circuit rapidly. The contactor consists of a glass tube containing a certain quantity of mercury, an inert gas to prevent oxidation or



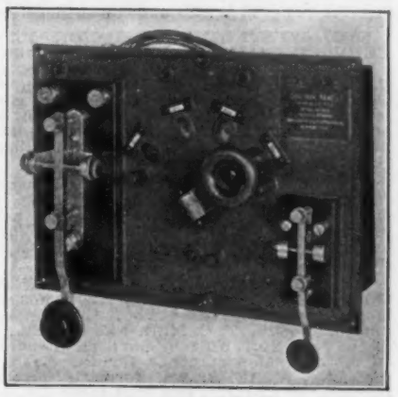
CAN BE BUILT INTO CONNECTOR OF ELECTRIC IRON

combustion, and two central electrodes with a gap between. The electrodes are connected to outside brass caps at each end of the tube. The simplest type of these contactors is operated by being tilted so that the mercury makes and breaks the circuit between the electrodes.

In the relay form of construction the necessity of tilting is eliminated by the use of a hollow iron cylinder which is lined with an inner sleeve of porcelain. The gap between the electrodes is inside of the iron cylinder, which is actuated by a magnetic coil around the glass tube.

Remote-Control Panel for Radio Operation

To save time and labor in the operation of radio sets of substantial size, the Wireless Specialty Apparatus Company, Boston, is just placing on the market a remote-control panel designed to govern important circuit adjustments



APPARATUS MAY BE INSTALLED WHERE CONVENIENT

at a distance from the main apparatus assembly. This equipment is being marketed for 2-kw. sets, is being built for 5-kw. sets and may be built soon for units up to 30-kw. rating.

MANUFACTURERS' ACTIVITIES

Record of Changes Affecting Sales and Distribution Together with Trade Personals and Notes on Foreign Trade, Jobbers' News and New Trade Literature

THE MATTHEWS ENGINEERING COMPANY, Monroe and Kings Street, Sandusky, Ohio, will start work at once on the erection of an addition, 100 ft. x 150 ft. to cost about $75,000. The company manufactures isolated electric lighting plants.

THE DUPLEX STORAGE BATTERY COMPANY, Milwaukee, organized about a year ago with a capital stock of $60,000, has filed articles of incorporation under the laws of the State of Delaware with a capital stock of $350,000, of which $70,000 is invested in Wisconsin. The company has moved its works from Milwaukee to Beaver Dam, where it occupies the former factory of the Beaver Dam Manufacturing Company, which it has remodeled.

THE GENERAL IGNITION & BATTERY COMPANY, 347 Florida Street, Milwaukee, Wis., is erecting an addition, two stories, 50 ft. x 65 ft., to its plant for manufacturing and repairing electrical automotive devices, storage batteries, etc.

THE BLACK & DECKER MANUFACTURING COMPANY, Towson Heights, Md., has established a new branch office at 303 Penn Avenue, Pittsburgh, Pa., in charge of W. D. Royer, formerly sales engineer of the Robbins Electric Company, Pittsburgh. This office will be the headquarters for the Black & Decker sales force in western New York, western Pennsylvania and the northwestern part of West Virginia. A service station has also been established at the same address.

THE WHITMAN ELECTRIC MANUFACTURING COMPANY, 352 South Avenue, Whitman, Mass., has enlarged its plant and is anticipating manufacturing other lines of electrical supplies in the near future. Arrangements have been made by the company with J. J. Wirtner, Wells Fargo Building, San Francisco, to act as its representative on the Pacific Coast. Negotiations are under way at the present time to secure a representative in Chicago to cover that district.

THE AMERICAN BLOWER COMPANY, 141 Broadway, New York City, manufacturer of mechanical draft equipment, fans, motors, etc., has increased its capital stock from $1,500,000 to $3,750,000. The company has plants at Green Island, N. Y., and Detroit, Mich.

THE SIMMS MAGNETO COMPANY, North Arlington Avenue, East Orange, N. J., is contemplating increasing its capital stock from $1,500,000 to $2,000,000. A bond issue of $500,000 is also under consideration.

THE WESTINGHOUSE UNION BATTERY COMPANY, Swissvale, Pa., which now occupies three stories in a building at the plant of the Union Switch & Signal Company, Swissvale, it is reported, contemplates the erection of new works on adjoining property. The present plans provide for increasing the output to three times the present capacity.

E. W. CHARLAND, Tilton, N. H., manufacturer of mica insulating materials, is enlarging his plant and installing new machinery to cut and to grind mica. When improvements are completed 1,000 lb. of mica washers will be cut per day.

THE AMERICAN BOSCH MAGNETO CORPORATION, Springfield, Mass., has enlarged its sales personnel at both the branches and main office. T. C. Mille, who had charge of the New York branch, has been advanced to district sales manager for the Eastern district. W. G. Brown, formerly branch manager at Chicago, has been made district sales manager of the Western district. M. Tost, former manager of the Detroit branch, has been advanced to district sales manager for the Central district. O. S. Stanley, who formerly acted as assistant branch manager of the New York branch, has been made manager. A. K. Chambers, formerly of general sales department at Springfield, Mass., has been appointed manager of the Chicago branch. R. S. Davy, until recently manager of the Bethlehem Motor Truck Company at Allentown, Pa., has been appointed branch manager at Detroit.

THE VATTER COMPANY, Louisville, Ky., manufacturer of batteries, etc., has increased its capital stock from $20,000 to $40,000.

THE NE PAGE-MCKENNY COMPANY, Seattle, Wash., electrical contractor and manufacturer, is planning to erect a two-story building, 61 ft. x 131 ft. to cost about $40,000.

THE LOUISVILLE ELECTRICAL MANUFACTURING COMPANY, 660 South Second Street, Louisville, Ky., is planning to erect a new plant, 60 ft. x 150 ft., for the manufacture of portable electric tools.

THE FRANKLIN APPLIANCE CORPORATION, Elizabeth, N. J., has filed notice of change in name to the Franklin Conduits Company. The company manufactures conduits and other electrical specialties.

LANDERS, FRARY & CLARK, New Britain, Conn, will soon begin the erection of two manufacturing buildings, one 50 ft. x 150 ft. and the other 50 ft. x 160 ft.

THE DE FOREST RADIO COMPANY, 1415 Sedgwick Avenue, New York City, recently lost its plant by fire. The damage is estimated at about $500,000.

THE BRENNER MANUFACTURING COMPANY, 19 Gray Avenue, Utica, N. Y., manufacturer of air compressors, etc., has filed notice of increase of capital stock from $250,000 to $500,000.

THE LEWIS & ROTH CORPORATION, Philadelphia, announces a change in name to the Electric Power Equipment Corporation. This change affects the name only. The personnel practically remains the same, as does the sales policy and manufactured product. All apparatus which was formerly manufactured by the Lewis & Roth Corporation will hereafter be designated as "Elpeco lines of equipment."

THE MERCURY MANUFACTURING COMPANY, 4118 South Halsted Street, Chicago, announces that J. R. Lewis has taken over the Cleveland office, succeeding Conrad Hibbeler, now in charge of the New England territory. Mr. Lewis has been with the Cleveland office as a salesman for a number of years. He will be assisted by E. S. Dawson, who will handle the Cincinnati territory as well.

THE M. W. DUNTON COMPANY, 150 Niagara Street, Providence, R. I., is moving into a new factory recently purchased, where it will have five times the space it formerly occupied.

THE AUTOMATIC RECLOSING CIRCUIT BREAKER COMPANY, Columbus, Ohio, announces the appointment of the W. D. Hammer Company, 508 Traction Terminal Building, Indianapolis, Ind., as its representative in the State of Indiana and western Kentucky.

THE LAKE ENGINEERING COMPANY announces the removal of its offices to 53 West Jackson Boulevard, Chicago.

THE WESTERN ELECTRIC COMPANY, 195 Broadway, New York City, has leased a one-story building at 505 St. Mark's Avenue, Brooklyn. The building contains about 20,000 sq.ft. and will be used for general works service.

STRAUSS & COMPANY, 306 West Fifty-second Street, New York City, have leased the property at 621-23 West Forty-second Street, on which they propose to establish a new plant, including an electric repair and construction department. The company manufactures metal display signs.

THE AMERICAN INSULATING MACHINERY COMPANY, Fairhill and Huntingdon Streets, Philadelphia, has filed notice of increase in capital stock from $50,000 to $200,000.

THE JOHN E. THROPP'S SONS, Lewis Street, Trenton, N. J., has acquired property in the vicinity of Fair Street for future extensions. The company manufactures rubber working machinery, mechanical stokers, etc.

THE VIRGINIA ELECTRIC & MACHINE WORKS, Charleston, W. Va., has filed notice of increase in capital stock from $50,000 to $100,000.

THE MUTUAL ELECTRIC & MACHINE COMPANY, Wheeling, W. Va., has increased its capital stock from $100,000 to $500,000.

THE INTERNATIONAL TIME RECORDING COMPANY, Binghamton, N. Y., has filed notice of increase in capital stock to $2,075,000.

THE NORTH AMERICAN STORAGE BATTERY COMPANY, it is reported, is planning to establish a plant at 40 West Pratt Street, Indianapolis, Ind., where it has leased 17,000 sq. ft. of floor space. The company proposes to manufacture starting and lighting batteries for motor cars and batteries for electric cars. H. E. Von Grimmenstein is president.

THE SUPERIOR ELECTRIC COMPANY, Pittsburgh, Pa., has leased a three-story building at 8 South Sixth Street, Philadelphia, which will be used as a branch factory. Improvements will be made to the building. The company manufactures electrical specialties.

THE NOVELTY ELECTRIC SIGN COMPANY, 165 Eddy Street, San Francisco, has leased a one-story and basement building to be erected at 435-37 Turk Street, which will be used for extensions.

Supply Jobbers' Notes

THE CAROLINA STATES ELECTRIC COMPANY, which was organized as a jobbing house at Charlotte, N. C., last April, has made unusual progress. Although the company has devoted its attention entirely to the states of North Carolina and South Carolina, it has developed a business among central stations, industrial plants and contractor-dealers in eight months which has called for a stock exceeding $150,000 and a large staff to handle it. It was originally intended to use three salesmen in soliciting business, but this has been found unnecessary owing to the volume of orders that have been received by mail. Eugene B. Graham, vice-president of the Charlotte Supply Company, one of the oldest mill supply houses in the South, is president, and H. T. Long, for seven years with the Westinghouse Electric & Manufacturing Company in Charlotte as manager of the lamp division, is vice-president. J. P. McMillan, for eight years in charge of the supply and apparatus department of the Westinghouse Electric & Manufacturing Company, is secretary, and W. A. Emerson, formerly in charge of the textile motor division of the Westinghouse Electric & Manufacturing Company, is treasurer. The company does a strictly distributing and jobbing business and has a large warehouse adjoining the offices of the Southern Power Company at Charlotte. The president of this company is inactive owing to his connection with the Charlotte Supply Company, and H. T. Long, vice-president, is in charge of the company's affairs.

Foreign Trade Notes

LACK OF FIRE-ALARM SYSTEMS IN SOUTH AMERICA.—George Hough Perry, director general of the American National Expositions, who is in Buenos Aires, Argentina, completing details for the opening of the United States Manufactures Exposition, March 4, 1921, writes that there is an excellent opportunity for American manufacturers of fire-alarm, fire-extinguishing and fire-prevention apparatus to develop trade in South America. In Buenos Aires, with a population of more than 2,000,000, Mr. Perry states there is no electric fire-alarm system.

THE MARCONI WIRELESS TELEGRAPH COMPANY OF CANADA, LTD., it is announced, has effected a merger with the Canadian General Electric Company, Toronto, Ontario. This follows upon the merger effected some time ago in the United States between the American Marconi Company and the General Electric Company of America under the name of the Radio Corporation of America. By this merger all of the Marconi interests in the British Empire now share in the use of all wireless patents of the General Electric Company of America.

ELECTRICAL GOODS IN SPAIN—The Department of Commerce, Bureau of Foreign and Domestic Commerce, Washington, D. C., has issued Special Agents' Series No. 197, entitled "Electrical Goods in Spain." It is a report by Trade Commissioner P. S. Smith on the markets for electrical goods in Spain and deals with existing generating plants, projected hydro-electric developments, electrical manufacturing and the future of the industry in that country.

HENRY S. MOOS, director tecnico, American Machinery Corporation, Sociedad Anonima Espanola, Zerrilla, 25, Madrid, has returned to Spain to present to Spanish users American machine tools and machinery. While in America Mr. Moos, in behalf of his associated companies, the American Machinery Corporation, S. A. E., Madrid, and Sindicato de Maquinaria Americana, Bilboa, has made arrangements to represent, among others, the following manufacturers: Cincinnati Electric Tool Company, Cincinnati Machine Tool Company, Detroit Electric Furnace Company, Heald Machine Company, Watson Stillman Company, United States Light & Heat Corporation, Curtain Supply Company and Globe Electric Company.

Trade Publications

COAL COMBUSTION.—"Automatic Combustion Control," descriptive of the Gray system of automatic control, is being issued by the Automatic Fuel Saving Company, 549 West Washington Boulevard, Chicago.

STEEL POLES.—The National Tube Company, Pittsburgh, Pa., has issued "National" bulletin 14C, a forty-seven page booklet on "National" tubular steel poles, with attractive photographs of installations.

CONTACTORS.—A bulletin describing the "absolute contactor," a mercury-contact form of switch, is being distributed by the Absolute Con-Tac-Tor Company, 127 North Dearborn Street, Chicago.

LIGHTING.—A second set of lighting data bulletins has been issued by the Edison Lamp Works of the General Electric Company as part of the company's lighting data library. These compromise bulletins L. D. 115 to 124 inclusive covering respectively lighting of armories and gymnasiums, the Edison "Mazda" lamp for stereopticon service, calculation of lighting installations, the history of the incandescent lamp, the manufacture of the Edison "Mazda" lamp, lighting of coal mines, medical lighting including hospitals and dental offices, commercial photometry, and lighting of shoe factories.

New Incorporations

THE BIGHEART (OKLA.) LIGHT & POWER COMPANY has been incorporated by Horace B. Wild, P. J. Minck, both of Bigheart, and J. C. Blankenship, Yale, Okla. The company is capitalized at $50,000.

THE GENERAL RESEARCH CORPORATION, Providence, R. I., has been incorporated with a capital stock of $300,000 to manufacture electrical specialties. The incorporators are Henry C. Hart, Patrick Curran and Karl Karkas, 147 Wheeler Avenue, Cranston, R. I.

THE COWLES ELECTRIC COMPANY, New Britain, Conn., has been incorporated by W. B. and C. W. Cowles and F. J. C. Ensworth, all of New Britain. The company is capitalized at $25,000 and proposes to manufacture electrical products.

THE WARE ELECTRIC COMPANY, Brockton, Mass., has been incorporated by Charles F. Hutch, Arthur G. Cole and Herman Dewhurst, East Bridgewater, Mass. The company is capitalized at $100,000 and proposes to manufacture electrical products.

THE ELECTRIC REGULATOR MANUFACTURING COMPANY, New York City, has been incorporated by J. G. Hockman, M. Samburg and A. M. Levy, 195 Chrystie Street. The company is capitalized at $100,000 and proposes to manufacture electrically operated regulating apparatus and other equipment.

THE PERFECTION ELECTRIC EQUIPMENT COMPANY, Newark, N. J., has been chartered with a capital stock of $50,000 to manufacture electrical products. The incorporators are C. C. Farr and Edward C. Daniels, 411 Halsey Street, Newark, N. J.

THE INLAND SPECIALTY COMPANY, 1460 North Robey Street, Chicago, Ill., has been incorporated by M. Spoland, N. L. Wellins and F. O. Singer. The company is capitalized at $25,000 and proposes to manufacture electrical toys.

THE LINCOLN LIGHT CORPORATION, Milwaukee, Wis., has been organized with a capital stock of $250,000 by Adolph Herbert and James Mahler, 219 Twenty-eighth Street, Milwaukee. The company proposes to manufacture generating equipment.

Construction News

Projects, Plans, Bids and Contracts, Contemplated or Under Way

New England States

MANCHESTER, N. H.—The Manchester Traction, Light & Power Company has increased its capital from $3,864,000 to $4,250,000, the proceeds to be used for new construction and general financing.

CAMBRIDGE, MASS.—Extensions and improvements to the power house of the C. A. Cook Company, 16 Osborn Street, will be made in connection with a plant extension to be erected. The cost is estimated at $30,000.

NEWBURYPORT, MASS.—The Newburyport Gas & Electric Company has applied to the Department of Utilities for permission to issue $850,000 in bonds to be used for expansion, financing, etc. A. W. Wood is president.

NORWICH, CONN.—The street-lighting committee of the Chamber of Comerce is making investigations in view of installing an ornamental street-lighting system. R. D. Judd is chairman of the committee.

Middle Atlantic States

BROOKLYN, N. Y.—Plans have been prepared for the Kings County Lighting Company, New Utrecht Street, for the erection of a generating plant at 5402 First Avenue to cost about $25,000.

BURDETT, N. Y.—The village officials have been granted authority by the State Public Service Commission to operate an electric lighting plant at this place and to secure energy from Watkins by means of a transmission line in Hector.

POUGHKEEPSIE, N. Y.—The Central Hudson Gas & Electric Company has filed notice of increase of $900,000 in its capital for general expansion.

READING, PA.—The installation of an electrically operated water purification system is planned by the City Council at a cost of about $600,000. E. L. Neubling is city water engineer.

WILLIAMSPORT, PA.—Bids will be received by H. A. Sterner, secretary of the School Board, until Jan. 13 for furnishing and installing electric light equipment for the Theodore Roosevelt and the Andrews G. Curtin Schools.

BALTIMORE, MD.—The Potomac Power & Development Company, care of W. H. Stineman and A. M. Quick, engineers, 418 Equitable Building, has had preliminary plans and surveys made for the development of a project to include the erection of a dam, 1,200 ft. long and 65 ft. high and a main dam, 1,200 ft. long and 22 ft. high; a 20,000-hp. power plant, including the installation of five 5,000-hp. vertical turbines, generators and three-phase, 60-cycle, 13,200-volt transmission lines; a 30,000-hp. power plant including the installation of five 700-hp. vertical turbines and generators; flood gates, 18 ft. x 30 ft., etc.

BALTIMORE, MD.—The Consolidated Gas & Electric Company, Lexington Building, is arranging a construction and improvement program for the coming year which includes $5,652,415 to be expended for the electrical department.

BALTIMORE, MD.—The Lafayette Mill & Lumber Company, Pulaski and Lafayette Streets, contemplates the erection of a new power house at its property.

BALTIMORE, MD.—Plans have been filed by the United Railways & Electric Company for the erection of an addition to its power house at Light and Heath Streets.

CRISFIELD, MD.—The erection of the McCready Memorial Hospital including a 42-ft. x 45-ft. power house, is contemplated at a cost of about $200,000. Fyle & Brown, 109 North Dearborn Street, Chicago, Ill., are architects.

FAIRMONT, W. VA.—The Monongahela Valley Traction Company contemplates the erection of a substation and extension of high-tension lines from Hutchinson to Clarksburg.

GRAFTON, W. VA.—The city officials plan to remodel the street-lighting plant at a cost of about $120,000. S. T. Scanlon is engineer.

CLARKSVILLE, VA.—The Roanoke River Development Company, Richmond, contemplates the erection of a hydro-electric plant on the Roanoke River at Bugg Island.

PORTSMOUTH, VA.—The City officials contemplate the installation of an electric power plant. J. P. Jervey is city manager and W. L. Davis is mechanical engineer.

RADFORD, VA.—The Norfolk & Western Railway, care of J. E. Crawford, Roanoke, contemplates the erection of a power plant, 60 ft. x 90 ft. The installation of a signal system is also planned.

North Central States

READING, MICH.—It is reported that the power house and other parts of the plan of the Acme Chair Company have been destroyed by fire causing a loss of about $150,000.

TRAVERSE CITY, MICH.—The city officials will have plans prepared for the erection of a 500-kw. steam-electric power plant to cost about $90,000.

CLEVELAND, OHIO—M. Makof, 3533 Woodland Avenue, contemplates the erection of a theater and office building at a cost of about $2,000,000. The company also plans to generate its own electricity.

DECATUR, IND.—Bids will be received by the city clerk after Jan. 1 for the erection of a municipal power plant.

CHICAGO, ILL.—The Sanitary District of Chicago, 900 Harper Building, contemplates the erection of a power house at East 125th Street, to cost about $538,000.

SHEBOYGAN, WIS.—The Board of Education has had plans revised for the erection of a central high school, and bids will be received about Jan. 1 for the first unit including a power and boiler house. The total cost is estimated at $1,250,000. Childs & Smith, 64 East Van Buren Street, Chicago, Ill., are architects.

Southern States

LENOIR, N. C.—The Catawba Valley Light & Power Company, Morgantown, contemplates the erection of a hydro-electric plant on Wilson Creek.

GREER, S. C.—Bonds to the amount of $40,000 have been voted for the erection of a transmission line from this place to Fair Forest to connect with the lines of the Blue Ridge Power Company.

BOYNTON, FLA.—Bonds to the amount of $10,000 have been voted for improvements to the electric light plant, etc.

SARASOTA, FLA.—Bonds to the amount of $35,000 have been sold for extensions to the municipal electric light plant.

ANNISTON, ALA.—The Alabama Power Company, Birmingham, contemplates the reconstruction of its Noble Street line at a cost of $40,000.

MILLINGTON, TENN.—An election will be held for the purpose of submitting to the voters a proposition to issue bonds to the amount of $20,000 for the erection of a new electric light and power plant.

OKLAHOMA CITY, OKLA.—Preliminary plans have been prepared for the erection of the American Legion Hospital to cost about $2,000,000. Plans include a 1,000 hp. power plant. C. P. Needer and M. Jayne, Empress Theater Building, are associate architects.

RANGER, TEX.—The Retail Merchants' Association will provide funds for the installation of fifteen blocks of street-lighting system at this place.

SAN ANTONIO, TEX.—The Hot Wells Mineral Bath & Hotel Company contemplates the erection of a dam across the San Antonio River for a hydro-electric plant to develop 140 hp. Plans include the installation of four turbines.

SNYDER, TEX.—The Snyder Utilities Company contemplates improvements to its electric light and ice plants.

Pacific and Mountain States

SPOKANE, WASH. — The Washington Water Power Company is having plans prepared by their engineering staff for immediate installation of a hydro-electric plant on the Spokane River to generate 14,000 hp. Contract for a hydraulic turbine wheel has been awarded to the William Cramp & Sons Ship & Engine Building Company, Richmond and Norris Streets, Philadelphia, Pa. Other contracts for generators, electric equipment, power house, etc., will be awarded as soon as plans are ready for submission to contractors.

WALLA WALLA, WASH. — The City Council recently discussed plans and specifications submitted by E. B. Hussey, engineer, Seattle, for the development of 900 hp. on Mill Creek. Mr. Hussey estimates the cost of the project at $381,000.

JEFFERSON, ORE.—Preliminary plans and estimates are being prepared by J. H. Cunningham, consulting engineer, Portland, for the erection of a proposed hydro-electric plant to develop about 1,500 hp. at this place.

KLAMATH FALLS, ORE.—The city budget of 1921 includes $10,000 for the installation of a fire-alarm system.

PORTLAND, ORE.—The initial movement by residents of this place to have all electric wires placed underground has been launched.

BRIDGEPORT, CAL.—The Southern Sierras Power Company, Riverside, has acquired the Lee Vining Creek Falls for hydro-electric power development. The electrical energy to be generated has been estimated at from 10,000 hp. to 20,000 hp.

KERMAN, CAL.—An election will be held on Dec. 27 to vote on the question of forming a public highway lighting district. D. M. Barnwell is clerk.

PASADENA, CAL.—Announcement has been made by C. W. Koiner, general manager of the municipal light plant, that enlargements will be made during the coming year to cost about $300,000.

RIVERSIDE, CAL.—The proposition to develop a large light and power scheme by Riverside, San Bernardino, Redlands and possibly other cities is under consideration. Mayor Porter of this place is interested.

SAN FRANCISCO, CAL. — The Pacific Gas & Electric Company has applied to the Railroad Commission for authority to issue $10,000,000 in bonds to carry out its hydro-electric construction program, particularly for what is known as the Pit River projects of the Mount Shasta Power Corporation, a subsidiary of the Pacific Company. It is also estimated that betterments and additions to the Pacific Gas & Electric Company's property for the years of 1921 and 1922 will cost in excess of $20,000,000.

SAN FRANCISCO, CAL.—The Sierra & San Francisco Power Company and the Pacific Gas & Electric Company have made joint application to the Railroad Commission for certificate of convenience and necessity for the construction of a power house on the Stanilaus River. Plans include one 7,000-kva. generator, three 2,500-kva. transformers and erection of an 18-mile transmission line, having a voltage of 104,000 volts.

SAN FRANCISCO, CAL. — The Federal Telegraph Company, Hobart Building, is having plans prepared for the erection of four wireless plants in the vicinity of Palo Alto, San Diego and Los Angeles, Cal., and Portland, Ore. The cost is estimated at $500,000, including equipment.

GLOBE, ARIZ.—City Engineer Genin and others contemplate a visit to El Paso, Tex., to investigate the lighting plan for the purpose of securing suggestions for a street-lighting system at this place.

Canada

GRANDE PRAIRIE, ALTA.—The plant of the Grande Prairie Electric Company will be taken over by the city officials on Jan. 1. It is also planned to purchase generator, exciter and transmission equipment in the spring.

PRINCE GEORGE, B. C. — C. Gordon, president of the Dominion Textile Company, 112 St. James Street, Montreal, Que., is interested in a project which includes the erection of a pulp and paper plant at this place to cost about $6,000,000 and the development of power on the Fraser River.

HALIFAX, N. S. — The Nova Scotia Power Commission contemplates the installation of a 20,000-hp. unit.

AVONMORE, ONT.—A by-law will be submitted to the ratepayers on Jan. 3 to vote on authorizing the borrowing of $9,000 for a hydro-electric plant.

HUTTONVILLE, ONT. — Residents of this place have petitioned the Brampton Hydro Commission to supply them with power. The commission estimates that the erection of a new line will cost about $10,000.

Record of Electrical Patents

Notes on United States Patents

(Issued Dec. 7, 1920)

1,360,999. ELECTRIC HEATER; Robert P. Barnstead, Boston, Mass. App. filed Oct. 29, 1919. Water heater cannot burn out.

1,361,017. WATER-HEATING ATTACHMENT FOR INTERNAL-COMBUSTION MOTORS; Oscar B. Clayton and George T. Oberwetter, Houston, Tex. App. filed March 16, 1920. Operates with motor at rest.

1,361,363. DYNAMO-ELECTRIC MACHINE; James Burke, Erie, Pa. App. filed April 23, 1917. Compensated machine with commutating poles.

1,361,425. ELECTRICAL CONNECTING AND SUPPORTING DEVICE; Ernst C. White, New York, N. Y. App. filed Jan. 10, 1920. For hanging and connecting fixture.

1,361,426. ELECTRICAL CONNECTING AND SUPPORTING DEVICE; Ernest C. White, New York, N. Y. App. filed Jan. 17, 1920. Supports and connects fixture on wall.

1,361,432. LOW-POTENTIAL ELECTRICAL SYSTEM AND METHOD OF CHARGING SAME; Hubert K. Wood, Bayside, N. Y. App. filed Nov. 23, 1917. Charging from 110 volts or 220 volts.

1,361,436. MAGNETO; Peter F. Bessy, Whiting, Ind. App. filed Dec. 3. 1918. For ignition.

1,361,437. MEANS FOR AUTOMATICALLY SUPPLYING STORAGE BATTERIES WITH DISTILLED WATER; Edward Blau, Newark, N. J. App. filed March 20, 1919. Maintains proper level.

1,361,442. ELECTRICALLY HEATED PERFORATOR; Alexander B. Campbell, Glasgow, Scotland. App. filed April 24, 1920. For perforating cloth by burning small holes therein.

1,361,448. ELECTRIC SYSTEM; John L. Creveling, Tucson, Ariz. App. filed Sept. 21, 1916. Automobile starter.

1,361,461. ELECTRIC LIGHT STRUCTURE; Max Herskovitz, Chicago, Ill. App. filed Apri 28, 1919. For table lamps.

1,361,486. COMPOSITE SIGNALING SYSTEM; Harold S. Osborne, New York, N. Y. App. fied Dec. 11 1918. Simultaneous telephone and telegraph.

1,361,487. PLURAL DEMODULATION CIRCUITS; Harold S. Osborne, New York, N. Y. App. filed Jan. 6, 1920. Selecting desired frequencies.

1,361,488. PLURAL MODULATION SYSTEM; Harold S. Osborn, New York, N. Y. App. filed March 31, 1920. Signals by carrier currents.

1,361,499. MANUFACTURE OF DRY CELLS; Otto E. Ruhoff, Madison, Wis. App. filed Jan. 30, 1920. No porous separator.

1,361,510. TELEPHONE TRANSMISSION SYSTEM; Ray S. Wilbur, Lyndhurst, N. J. App. filed Dec. 10, 1917. Two-way, two-repeater circuits.

1,361,522. PLURAL MODULATION SYSTEM; Lloyd Espenschied, Queens, N. Y. App. filed March 18, 1920. Telegraph signals by carrier currents.

1,361,533. ELECTRICALLY HEATED AUTOMOBILE HOOD AND RADIATOR COVER; George T. Newell, Jr., Beverly, N. J. App. filed Feb. 2, 1920. To prevent freezing.

1,361,546. DYNAMO-ELECTRIC MACHINE; Peter P. Politowski, Chicago, Ill. App. filed June 23, 1917. Number of poles may be varied.

1,361,556. ELECTRIC HEATER; Herbert E. Welchel and Aaron A. McCray, Indianapolis, Ind. App. filed July 12, 1920. Heater and fan.

1,361,557. ELECTRIC LAMP; Grant Wheat, Corry, Pa. App. filed Jan. 8, 1917. Miner's.

1,361,590. TELEPHONE TRANSMITTER; Henry Koch, Jamaica, N. Y. App. filed Sept. 3, 1919. Used in automobiles.

1,361,623. PUFF IRON; Benjamin Schindler and Jacob G. Viertel, Freeport, N. Y. App. filed June 26, 1919. Standing iron.

1,361,642. LAMP-SOCKET CONSTRUCTION; Oscar S. Swanson, Jamestown, N. Y. App. filed Dec. 10, 1918. Shell body easily engaged with cap.

1,361,650. IGNITION DEVICE FOR GAS STOVES; Joseph Varin, Montreal, Quebec, Can. App. filed Jan. 13, 1920. Attached to lighting circuit.

1,361,651. BATTERY-PROTECTING DEVICE FOR CHARGING AND LIGHTING SYSTEMS; Richard Varley, Englewood, N. J. App. filed Nov. 29, 1919. Protective relay.

1,361,652. WELDING APPARATUS; Miner P. Wetmore, Newark, N. J. App. filed April 29, 1920. For mounting filaments of incandescent lamps.

1,361,675. CURRENT-CONTROLLING DEVICE; Lynde Bradley, Milwaukee, Wis. App. filed Feb. 12, 1916. Compression resistor.

1,361,676. MEASURING AND INDICATING APPARATUS; Henry Brewer, Philadelphia, Pa. App. filed Feb. 21, 1919. Graphic meter.

1,361,710. QUARTZ MERCURY-VAPOR LAMP; Henri George, Paris, France. App. filed April 11, 1919. For alternating current.

1,361,795. HEAT DISTRIBUTER; George E. Latham and William F. Whiteman, San Francisco, Cal. App. filed July 1, 1919. Radiator.

(Issued Dec. 14, 1920)

1,361,800. VOLTAGE-PROTECTIVE DEVICE; Chester T. Allcutt, Wilkinsburg, Pa. App. filed Sept. 1, 1917. Liquid type.

1,361,801. LIGHTNING ARRESTER; Chester T. Allcutt, Wilkinsburg, Pa. App. filed Sept. 1, 1917. Telephone.

1,361,806. CLAMP TERMINAL; Mathew A. Allison, Canebrake, W. Va. App. filed Feb. 5, 1919. Readily applied or disconnected.

1,361,813. RADIO CABINET; Wilfred E. Booth, New York, N. Y. App. filed July 19, 1917. Receiving and sending unit.

1,361,885. AUTOMATIC TELEPHONE SYSTEM; Talbot G. Martin, Chicago, Ill. App. filed Dec. 8, 1917.

1,361,912. SWITCHING APPARATUS; William M. Scott, Tredyffrin Township, Chester County, Pa. App. filed Aug. 29, 1917. Automatic control.

1,361,928. TESTING AND ADJUSTING APPARATUS FOR CORD CIRCUIT; John F. Toomey, New York, N. Y. App. filed May 3, 1917. Indicates improper operation.

1,361,929. MONITORING CIRCUIT FOR TELEPHONE REPEATERS; John F. Toomey, New York, N. Y. App. filed May 18, 1917. Operation of repeater interconnecting two lines may be observed.

1,361,934. MOTOR STARTER; Hermon L. Van Valkenburg, Milwaukee, Wis. App. filed Sept. 7, 1918. Running switch cannot be closed in less than predetermined interval.

1,361,935. MEANS FOR ADJUSTING AND INDICATING THE TRAVEL OF MACHINE OR INSTRUMENT OPERATED BY THE CORE OR ARMATURE OF AN ELECTROMAGNET; Edward C. Villiers, Hendersyde, Ascot, England. App. filed Nov. 12, 1918.

1,361,945. MEANS FOR DELIVERING MATERIAL FROM ROLLS; William M. Wheildon, Ashland, Mass. App. filed April 6, 1918. Taping machine.

1,361,946. BATTERY HAND LAMP; George D. Gallagher, Washington, D. C. App. filed April 13, 1920. Cushioned lamp.

1,361,948. INSULATOR; James L. Widmyer, Minneapolis, Minn. App. filed Sept. 29, 1919. For telephone, telegraph, etc.

1,361,954. COMBINED FOOT SUPPORT AND HEATER FOR VEHICLES; Alfredo Zecchini and Innocente Panza, Turin, Italy. App. filed Feb. 24, 1920. Electrically heated.

1,361,955. METER-TEST DEVICE; Albert P. Ball, Royal Oak, Mich. App. filed July 17, 1917. For customers' meters.

1,361,967. LIGHTNING ARRESTER; Almon W. Copley, Wilkinsburg, Pa. App. filed Sept. 1, 1917. Discharge-gap type.

1,361,968. BRUSH HOLDER; John S. Dean, Edgewood Park, Pa. App. filed Feb. 3, 1917. Will not materially injure commutator by accidental engagement.

1,361,980. TELEPHONE SYSTEM; Charles L. Goodrum, Brooklyn, N. Y. App. filed Dec. 30, 1916. Machine switches.

THIS ISSUE CONTAINS THE INDEX FOR VOL. 76

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Electrical World

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W. H. ONKEN, JR., *Editor*

Contents

Editorials 1245
Cheerfulness as an Antidote to Depression—Commemorating the Electrical Pioneers—Careless Thinking on Rural Problem Needs Correcting—The Power Development of the Future—Errors that Meter Records Should Eliminate—Insufficient Furnace Capacity an Enemy to Economy—Getting Away from Antipathy—Utilities Entitled to More than Current Investment Earnings.

Frontispiece—Harold Winthrop Buck 1248

The Justice of Current-Cost Valuations 1249
By Philip Barton Warren.
Although Original Cost Will Give Some Figure, Provided that Proper Relative Weight in Purchasing Power Is Given in Dollar, Still the Dollar Now Current Is the One Which the Utility Pays Out for Supplies and Receives for Energy.

Adapting Signal Indicators to Power Plant Use 1251

Economies of Melting Brass Electrically 1253
Operating Records Show the High Economy that Has Been Attained by the Utilization of Small Rotating Arc-Type Furnaces in Brass Foundries—Preheating for One Shift Successfully Eliminated.

Meter Records Can Be Simplified 1256
By Edward Howell and Charles L. Rose.
A Record that Requires a Minimum of Labor but Is a Thorough Check Against Loss—Shortage of Competent Metermen Makes Training School Necessary—Rules for Guidance of Wiring Contractors Found Necessary.

Determining Corona Voltages for Actual Lines 1258

Developing the Low-Head Plant 1260
By Louis E. Ayres.
Rehabilitation of the Old Plants by Installing Hydraucones with High-Speed Runner—Gain in Efficiency Should Be at Least 25 per Cent — Comparison of Hydraucone with Stream Line Draft Tube.

Magnetic Forces in Disconnecting Switches 1263

Readers' Views and Comments 1264

Station and Operating Practice 1265

Industrial Applications 1267

Central Station Service 1270

Digest of Electrical Literature 1272

News in Brief 1274

News of the Industry 1275

Current News and Notes 1281

Associations and Societies 1281

Court Decisions 1282

Commission Rulings 1282

Men of the Industry 1283

Trade and Market Conditions 1284

New Apparatus and Appliances 1289

Manufacturers' Activities 1290

Construction News 1291

Record of Electrical Patents 1292

Advertising Index—Alphabetical, 145; Classified, 139, 141, 143; Directory of Engineers, 36, 37; Searchlight Section, 38-69

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Change of Address—When change of address is ordered the new and the old address must be given. Notice must be received at least ten days before the change takes place.

Circulation of this issue 26,000

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Westinghouse

Porcelain Insulators

No. 2-33

No. 3-66

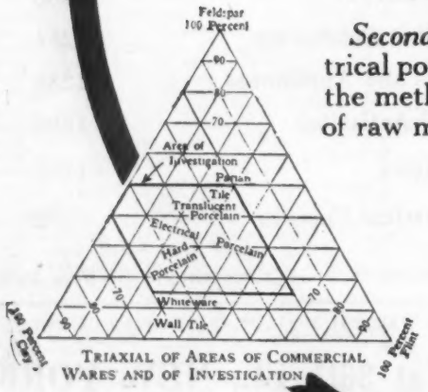
High-Tension Insulators are produced from raw materials having the same basic compositions as raw materials used to produce many other vitrified articles. The triaxial, shown below to the right, indicates the proportioning of the various products.

Our factory exercises greater care in the selection and proportioning of ingredients than do the manufacturers of the best grades of dishes and artware.

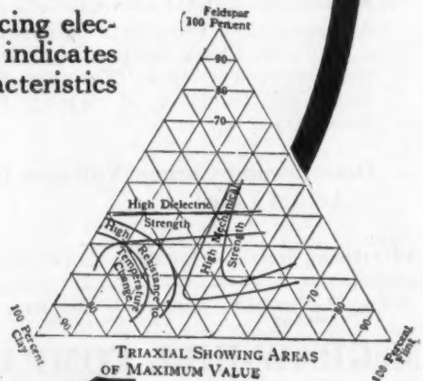
A highly specialized corps of engineers are experimenting continually to:

First, maintain a uniformly high quality.

Second, to improve the art of producing electrical porcelain. The triaxial to the left indicates the methods used in determining characteristics of raw materials.



TRIAXIAL OF AREAS OF COMMERCIAL WARES AND OF INVESTIGATION



TRIAXIAL SHOWING AREAS OF MAXIMUM VALUE

W
WESTINGHOUSE ELECTRIC

Westinghouse Electric & Manufacturing Co.
Pittsburgh High-Voltage Insulator Works
Derry, Pennsylvania

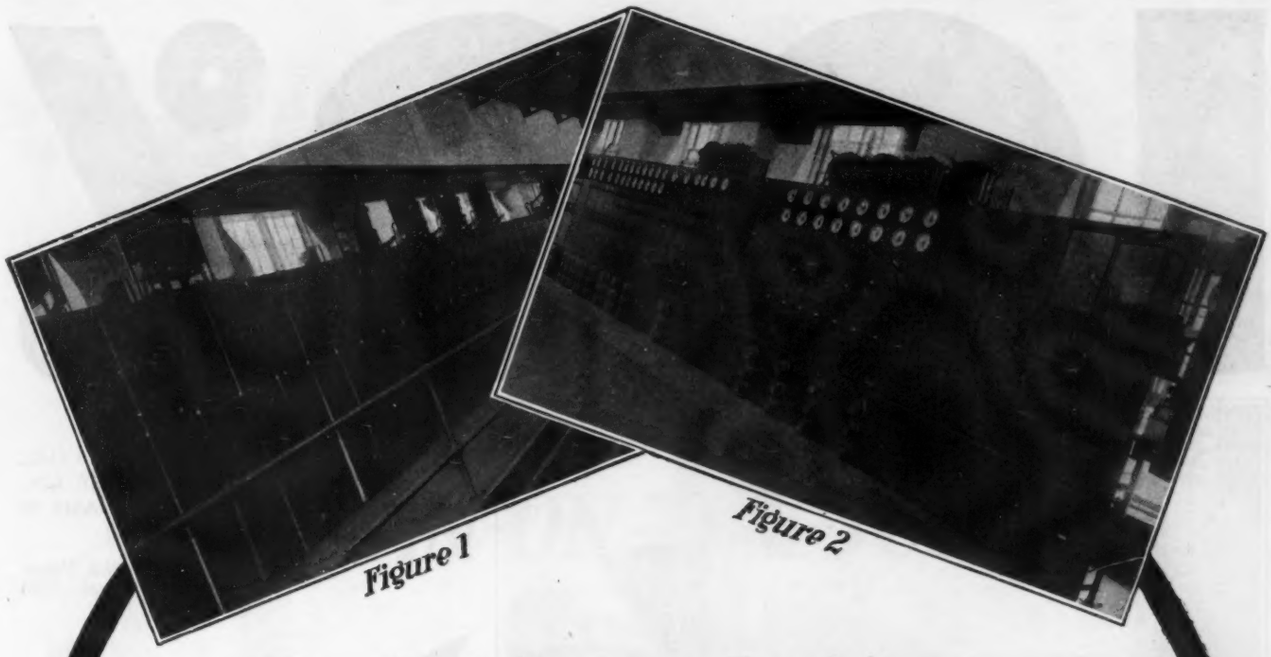


Figure 1

Figure 2

The Satisfactory Performance of Westinghouse Switch Gear

in the Appleton Power House of the Wisconsin Traction, Light, Heat and Power Co., is evidenced by the additions both to the switchboard and to the high-tension breakers.

The 25-panel Switchboard (Figure 2) controls four turbine generators and two water-wheel generators, totalling 16,300 kv-a. at 4,000 volts, 3-phase, 60 cycles; also, two 500 kv-a. synchronous motors and the necessary exciter equipment.

The Type E-6 oil circuit-breaker structure (Figure 1) comprises two 300, five 600 and two 1200 ampere, electrically-operated breakers. Nine multiple, single-pole, 300 ampere Type F-2 breakers are also included.

Distribution is made at both 33,000 volts and 66,000 volts, for which a number of 37,000 volt, Type G-1 and 73,000 volt, Type G-11, oil circuit breakers were furnished.

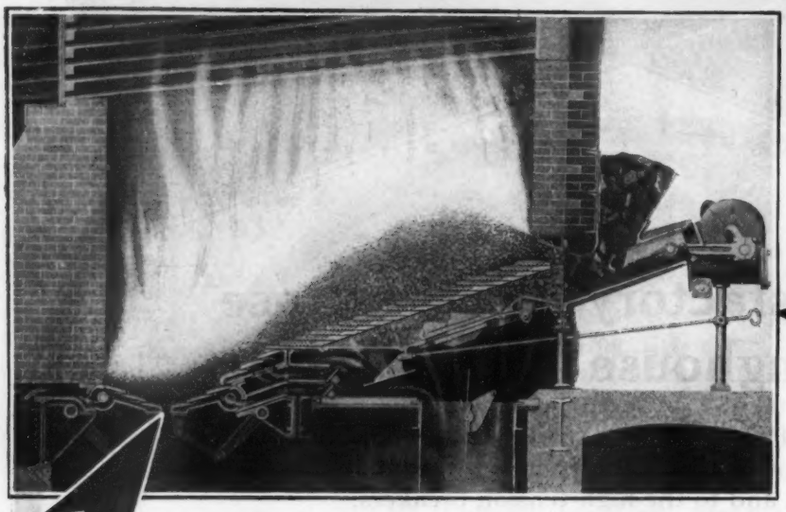
Westinghouse Electric & Manufacturing Co.
East Pittsburgh, Pa.

1363

W
WESTINGHOUSE ELECTRIC

Westinghouse

100%



"IF YOU CONSIDER YOUR COAL AT ITS CASH VALUE, THE UNBURNED COAL IN THE ASH IS LIKE SMALL CHANGE."

Industrial Power
Sept. 1920

The "small change" of the Boiler Room, is the unburned fuel that passes over the dump grate.

100% Air Distribution prevents the loss of this "small change."

100% Air Distribution means that the Westinghouse Underfeed Stoker is a stoker through and through—that every square foot of grate surface is active grate surface from front wall to bridge wall.

100% Air Distribution means that the DUMP GRATE is dump grate ONLY—it is ACTIVE GRATE SURFACE to be used when needed. It is supplied with air so that every particle of unburned fuel reaching it may be efficiently consumed.

No "small change" passes over the dump grate of the Westinghouse Underfeed Stoker.

Ask for leaflet 3985 describing the Westinghouse System of Air Distribution.

Westinghouse Electric & Mfg. Co.
East Pittsburgh, Pa.
Sales Offices in All Large American Cities

W
WESTINGHOUSE ELECTRIC

Westinghouse

UNDERFEED OVERFEED AND CHAIN GRATE STOKERS.

MAN-ON-THE-JOB SAYS:

Western Electric

"Supplies are OK, everything is ready for use—there are no culls or defective pieces"

Western Electric Quality Products include everything for electrical work.

Flexible Cords
Habirshaw Wire
Conduit and Supplies
Switches—Sockets
Insulating Material
Lamps—Shades
Tools

Held ready for shipment at 48 conveniently located houses.

Western Electric Company

Offices in All Principal Cities

ELECTRICAL WORLD
Why?
Why are approximately 50% of the train lighting systems of the United States equipped with Sangamo Meters? (No meters whatever used on other systems.)
Why?
SANGAMO
Sangamo Electric Company
Springfield, Illinois
Specialists in Meters for Every Electrical Need

SANGAMO

The Question and the Answer

You know from experience the strains of sudden stops and starts and the results of continuous vibration. Just consider what this would do to the meter with ordinary jewelled bearings. A meter for such service must be a staunch, sturdy and exceptional instrument.

The Sangamo Type D5 ampere-hour meter has no jewelled step bearing to chip or break, the moving element is floated on mercury, which absorbs all the jerks and jars common to car operation.

Years of experience on Pullman cars and on the coaches of railroads throughout the country have demonstrated that Sangamo meters are the only meters of sustained accuracy under all service conditions.

Sangamo Electric Company
Springfield, Illinois

Specialists in Meters for Every Electrical Need

2093

Keep the Keystone in Place

Keep this Incident in Mind

Here is a little news item clipped from the "News Service Bulletin" 4/12/20. It carries with it some real food for present day thought.

"CLINTON, KY.—This city of 2500 population in Western Kentucky is without water and electric light, after enjoying these utilities for more than 20 years. The people are using kerosene lamps, carrying lanterns at night and carrying water from nearby springs and wells.

The local company was unable to cope with the increased cost of coal, labor and operating supplies and had to shut down the plant. The city then undertook to operate the property, but found it too expensive and closed down. The local Commercial Club has raised $10,000 which will be offered as a bonus to anyone who will purchase and operate the plants. Business men say that real estate has depreciated very much in value and that people are leaving for places that can afford substantial utility service."

The next time you hear anyone knocking the lighting company in your locality tell them this little story. It will serve to gain a higher appreciation of electric service by the public—something that is badly needed now for the good of the whole industry.

Don't you want to help?
Carry on the good word.

THE ELECTRIC STORAGE BATTERY CO.

Oldest and largest manufacturers in the world of Storage Batteries for every purpose

1888 PHILADELPHIA 1920

Branches in seventeen cities

Special Canadian Representatives: Chas. E. Goad Engineering Co., Limited, Toronto and Montreal

ORANGEBURG FIBRE CONDUIT

THE FIBRE CONDUIT CO. REG. U.S. ORANGEBURG PAT. OFF ORANGEBURG, N.Y.

The Original Fibre Conduit

Orangeburg fibre conduit was the first fibre conduit to be made in this country. It has been manufactured and used for 27 years. During that time an enviable reputation has been built up around the name "Orangeburg" until it has become accepted as the *best* in conduit material.

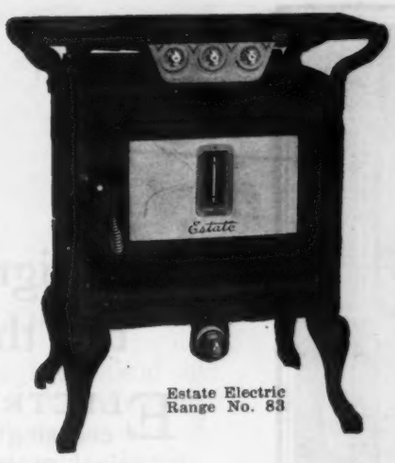
It is the criterion by which other conduit material is judged.

THE FIBRE CONDUIT COMPANY

Orangeburg, N. Y.

New York Boston Chicago San Francisco New Orleans

Estate Electric Range No. 88



Estate Electric Range No. 83

Estate Electric Range No. 82

Prestige

"Authority or importance based on past achievements; the moral influence of reputation or of former character or success"—that's prestige.

And that is just one of the things which make Estate Electric Ranges easy to sell.

Estate
ELECTRIC RANGES

The splendid record made by Estate Stoves and Ranges through three-quarters of a century is an invaluable asset to the dealer who sells Estate Electric Ranges.

Their performance arouses enthusiasm. They are tested and approved by The Underwriters' Laboratories, Good Housekeeping Institute and the New York Tribune Institute. Each of the five models has important exclusive features which appeal to the customer at first sight. And once sold, they *stay* sold.

Estate Electric Ranges are simple—not spectacular. Their strong, sturdy appearance inspires confidence.

Write now for full information.

THE ESTATE STOVE COMPANY

Manufacturers of High-Grade Stoves and Ranges since 1845

Hamilton, Ohio

4 EXCLUSIVE Estate Features

Quick-Detachable Surface and Oven Units of Estate Iron-Clad Construction.

All Cast-Iron Cooking Top.

Mercury Thermometer in Oven Door.

Estate Copyrighted Cooking Chart.

Estate Sunburst

"Warmth on the Dot and Right on the Spot." Every wired home is a prospect.

Estate Electric Range No. 84.

Estate Combination Coal and Electric Range No. 81

Distributors of Estate Electric Ranges:

ASHEVILLE, N. C.
Piedmont Elec. Co.

ATLANTA, GA.
Fulton Elec. Co.

BOSTON, MASS.
Geo. H. Wahn Co.

BUFFALO, N. Y.
The Milner-Flower Elec. Co.

CHICAGO, Ill.
American Elec. Supply Company

DENVER, COLO.
Tritch Hardware Co.

DETROIT, MICH.
Miller-Seldon Elec. Co.

GREEN BAY, WIS.
Morley-Murphy Hdw. Company

HARRISBURG, PA.
Dauphin Elec. Supplies Company

JACKSONVILLE, FLA.
Holt Electric Co.

LOS ANGELES, CALIF.
Listenwalter & Gough, Incorporated

MINNEAPOLIS, MINN.
Morley-Murphy Hdw. Company

NEW YORK CITY
Alpha Elec. Co., Inc
Manheim Brothers (Export Trade Only)

OMAHA, NEBR.
Wright & Wilhelmy Co.

PEORIA, ILL.
Diamond Elec. Supply Company

PHILADELPHIA, PA.
Walker & Kepler

PITTSBURGH, PA.
Doubleday-Hill Elec. Company

PORTLAND, ORE.
North Coast Elec. Co.

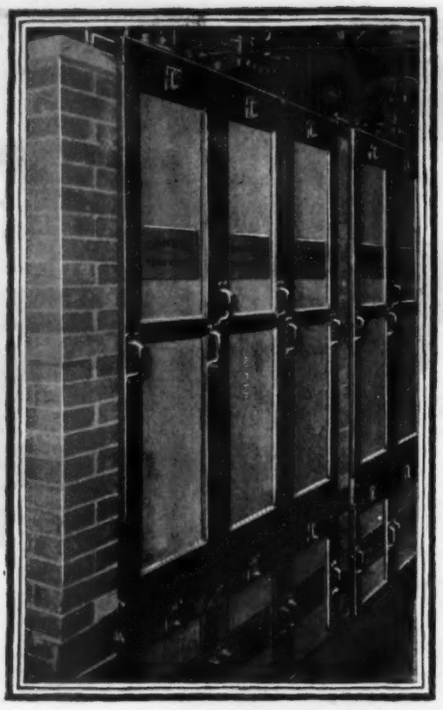
ST. LOUIS, MO.
Fidelity Elec. Co.

SAN FRANCISCO, CALIF., Alexander & Lavenson Elec. Supply Company

SCRANTON, PA.
The Chas. B. Scott Co

SEATTLE, WASH.
North Coast Elec. Co.

TACOMA, WASH.
North Coast Elec. Co.



The signs can only warn but the barriers protect

ELECTRICAL barriers are used increasingly in station construction—a physical protection against thoughtless or accidental contact with electrical apparatus is far superior to any number of warning signs. And the necessity for barriers which can create no hazard through deterioration or structural weakness makes Johns-Manville Transite Asbestos Wood most desirable for this purpose.

For Transite Asbestos Wood is a material of great physical strength, positively fireproof and is not liable to warp or crack and it is light and easily worked.

Even though you have signs to warn, you need barriers of Transite to *protect*.

JOHNS-MANVILLE SERVICE COVERS THIS CONTINENT

Through—

Asbestos

and its allied products

JOHNS-MANVILLE
Serves in Conservation

Heat Insulations, High Temperature Cements, Asbestos Roofings, Packings, Brake Linings, Fire Prevention Products

JOHNS-ELECTRICAL

A combination cutout and switch— The Noark Service Box

A TWIST of the handle on the cover of a Noark Service Box engages the fuses on the inside, breaking the circuit when the box is opened.

Or the cover can be opened without breaking the circuit by twisting the handle in the opposite direction, leaving the fuses in the clips.

Noark Service Boxes are tested at four times their rated voltage —this means protection against "shorts" or "grounds."

All Noark Service Boxes are approved as entrance switches by the Underwriters' Laboratories, Inc.

How strong should a switchboard be?

PHYSICALLY,—strong enough to stand up under repeated blows from a heavy circuit breaker; strong enough to stand the knocks of shipping and handling, strong enough to be immune to rapid temperature changes; strong enough not to warp, shrink, crack *or* buckle even under extreme service conditions.

Electrically—strong enough to keep surface leakage down to the minimum, regardless of oil or atmospheric moisture; strong enough not to break up under the highest voltage encountered in your plant; strong enough to prevent stray currents such as are due to metallic veins as in some materials.

Both physically and electrically, Ebony Asbestos Wood meets all of these requirements. In addition it is easily worked and has a handsome appearance equal to that of the best oiled slate.

Send for the booklet and for samples to test

JOHNS-MANVILLE
Incorporated
Madison Ave. at 41st St., New York City
10 Factories—Branches in 64 Large Cities
For Canada:
CANADIAN JOHNS-MANVILLE CO., Ltd., Toronto

MANVILLE MATERIALS

The moulded insulation you need—we make it

YOUR own particular requirements are the governing factors in the selection of Johns-Manville Moulded Insulation. Very probably the conditions you have to meet are not such that standard materials will do.

That doesn't make a bit of difference. Johns-Manville Moulded Insulation isn't just a standardized mixture—it is exactly the one compound, determined by experiment, that will give the results you want. Maybe it's mica-shellac, or phenol base, or any of a hundred or more combinations—whatever it is, we make it.

BAKELITE

REG. U. S. PAT. OFF.

A Camera FRAME

Permanent finish and strength were essential, and economical manufacture was desirable, in this camera frame, yet all three were obtained by using Bakelite, *moulded.*

Perspiration will destroy the finest wood finish, will materially shorten the life of enamel, and will cause a leather surface to rot and crumble. A material was therefore required which would resist perspiration and preserve a fine, glossy surface; which could be easily shaped, yet still be strong, hard, and durable.

Moulded Bakelite has ably qualified. In one operation in the moulding process the sides of this camera frame were produced complete in every detail. The recessed chambers of the inner surface, the cross grain pattern of the outside, and the smooth polished edges were all accomplished in the mould.

Aside from producing a better product, moulding with Bakelite actually saved much tedious and expensive assembling. And this is a point to consider in connection with your problems—perhaps Bakelite will save money for you, too.

GENERAL BAKELITE COMPANY

Two RECTOR STREET NEW YORK, N. Y.

We welcome inquiries from manufacturers and maintain a research laboratory for the working out of new applications.

"Off Agin On Agin"
Says Finnegan

WITH four words and a broad grin, Finnegan expressed the function of the Condit Type N-1 Oil Motor Starter better than we have ever been able to do it.

"Off agin!" Whenever there is an electrical disturbance—overload, short circuit, under-voltage, or loss of phase—the switch is tripped, the circuit broken under oil, and the current turned *off*.

"On agin!" The motor is started *instantly* in less than ten seconds, by throwing the switch first to the "starting" then to the "running" position. There is no delay in switching the current *on*.

And the broad grin? Well, Finnegan had been used to working with a fuse-protected switch. Whenever a fuse blew, it meant a delay of from twelve to twenty minutes, an interruption of production which the good workman dreads as much as the president of the company does. The grin celebrated the end of all that.

It will pay you to install just one Type N-1 Starter. Then compare the production curves of the motor it protects with a fuse-protected motor of the same type. Ask us to send the nearest Condit engineer to see you.

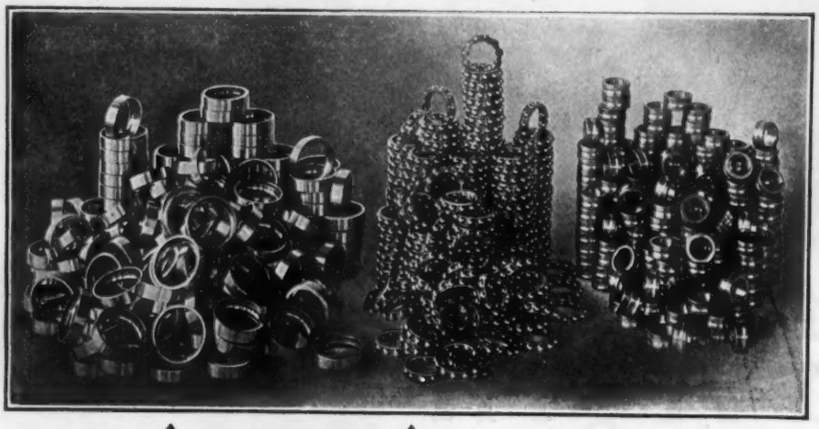
CONDIT ELECTRICAL MANUFACTURING CO.
South Boston, 27, Mass.

CONDIT

"NORMA"

INTERCHANGEABILITY

Here is a pile of "NORMA" outer races—a pile of "NORMA" cages with balls—and a pile of "NORMA" inner races,



You may select any outer race from this pile.

And any cage with balls from this pile.

And any inner race from this pile.

Put them together—and you have a perfect "NORMA" Precision Ball Bearing—accurate as to size and dimensions and alignment — perfect as to true and silent running — as "frictionless" as a ball bearing can be made.

This is "NORMA" interchangeability—and we believe there is nothing to equal it, in the world of ball bearings.

Do you know of any other ball bearing that can be assembled from stock this way — and still be a perfect bearing?

Think what this means, in facilitating that progressive assembling which reduces costs and increases production.

The Norma Company of America

Anable Avenue, Long Island City, N. Y.

Pressed Steel Case Pittsburgh Transformers

THE ORIGINAL
Pressed Steel Case
Transformer

THE ORIGINAL
Pressed Steel Case
Transformer

Pittsburgh case construction is of steel plate.

All joints are welded—no solder used, nor brazing.

Bushings issue at an angle of 30 degrees away from the case, both inside and outside, providing great clearance and preventing danger of short circuit to case.

Leads are covered with specially treated, rosin oil paper, which is not injured by hot transformer oil.

No rubber is used in the transformer, as rubber will disintegrate in transformer oil.

Lugs for lifting securely riveted to the case, take any lifting pressure or strain off the core and coils and distribute it equally through the case.

Cases are painted battleship gray, giving them a finer finish than the old black paint.

All Pittsburgh Transformers have steel cases or tanks. We have abandoned cast iron, because it is porous and will not hold hot transformer oil without leaking.

Pittsburgh Transformer Company

Largest Manufacturers of Transformers exclusively in the United States

Pittsburgh, Pa.

District Offices:

30 Church Street
New York

724 Harris Trust Building
Chicago

601 Electric Building
Buffalo

Distributors:

Rumsey Electric Company
Philadelphia

Iron City Electric Company
Pittsburgh

J. F. Schaefer & Company
Kansas City

Triumph Electric Company
Minneapolis

R. M. Cass
Indianapolis

L. Rose Equipment Company
St. Louis

Wetmore-Savage Company
Boston

Verne W. Shear & Company
Akron—Cleveland—Youngstown

Electric Supply & Equipment Company
Charlotte

Eicher & Bratt
Seattle

F. H. Boyer
Des Moines

Federal Sign System (Electric)
New York—Chicago—San Francisco

F. R. Jennings Company
Detroit

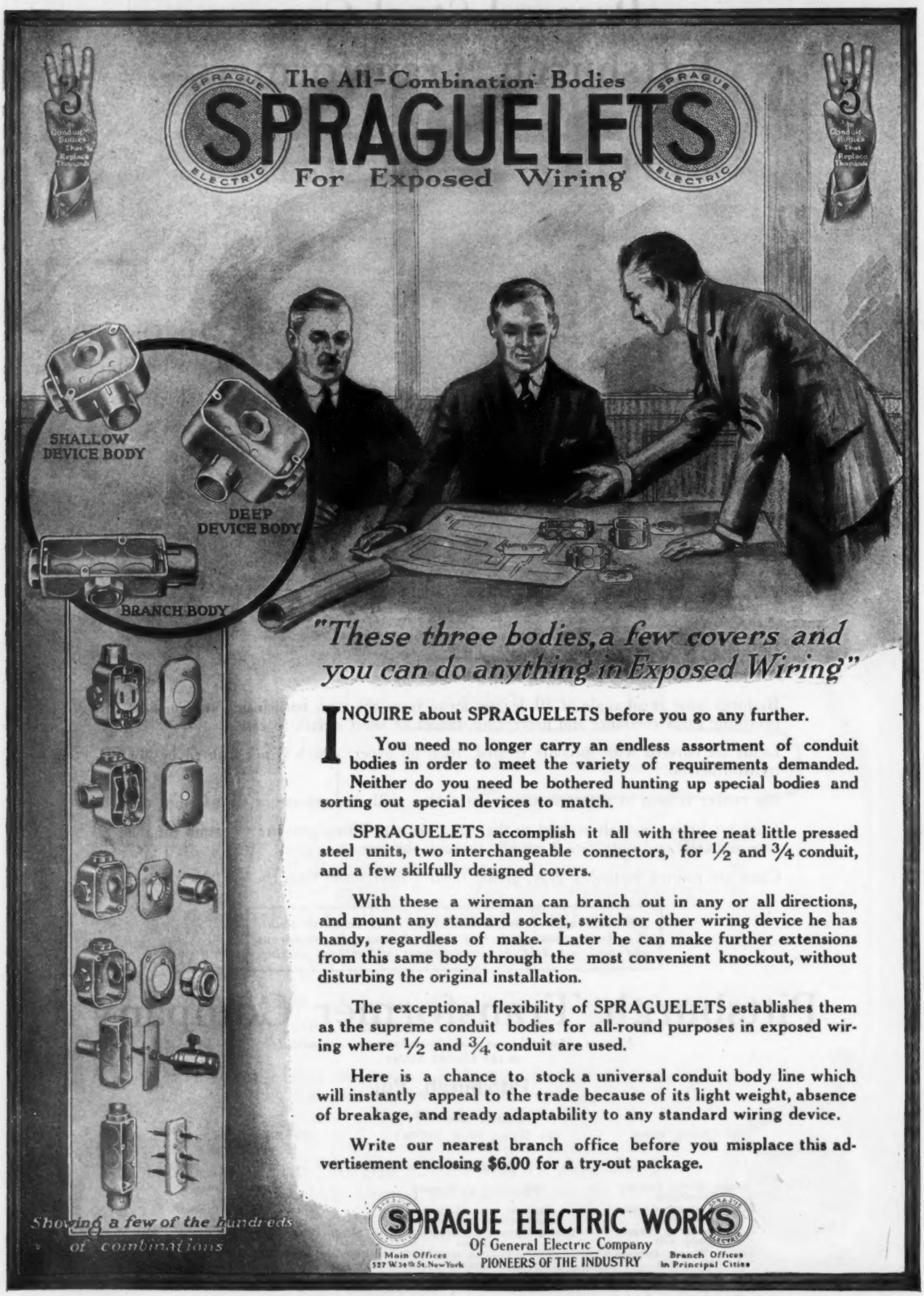
General Machinery Company
Birmingham

Piper Engineering Company
Cincinnati

Coast Equipment Company
San Francisco

F. W. Wilson
Salt Lake City

Southern Electric Supply Company
Atlanta


3
Conduit Bodies That Replace Thousands
The All-Combination Bodies
SPRAGUELETS
For Exposed Wiring
SPRAGUE ELECTRIC
3
Conduit Bodies That Replace Thousands
SHALLOW DEVICE BODY
DEEP DEVICE BODY
BRANCH BODY
"These three bodies, a few covers and you can do anything in Exposed Wiring"
Showing a few of the hundreds of combinations
INQUIRE about SPRAGUELETS before you go any further.
You need no longer carry an endless assortment of conduit bodies in order to meet the variety of requirements demanded. Neither do you need be bothered hunting up special bodies and sorting out special devices to match.
SPRAGUELETS accomplish it all with three neat little pressed steel units, two interchangeable connectors, for 1/2 and 3/4 conduit, and a few skilfully designed covers.
With these a wireman can branch out in any or all directions, and mount any standard socket, switch or other wiring device he has handy, regardless of make. Later he can make further extensions from this same body through the most convenient knockout, without disturbing the original installation.
The exceptional flexibility of SPRAGUELETS establishes them as the supreme conduit bodies for all-round purposes in exposed wiring where 1/2 and 3/4 conduit are used.
Here is a chance to stock a universal conduit body line which will instantly appeal to the trade because of its light weight, absence of breakage, and ready adaptability to any standard wiring device.
Write our nearest branch office before you misplace this advertisement enclosing $6.00 for a try-out package.
SPRAGUE ELECTRIC WORKS
Of General Electric Company
Main Offices 527 W. 34th St. New York
PIONEERS OF THE INDUSTRY
Branch Offices in Principal Cities

The UNIVERSAL ELECTRIC CLOTHES WASHER

"WASHES WITHOUT WEAR"

Mfd. by UNIVERSAL UTILITIES CORP. ALPENA, MICH.

RETAIL PRICE $55.00 COMPLETE

Why Pay More ?

Here is the Lowest Priced (All-Metal) Electric Clothes Washer Ever Marketed

Universal Features

Simplest, easiest and safest to operate. Only four moving parts.

Can be used ANYWHERE AND EVERYWHERE where all other Electric Washers fail to operate, because of its compact construction.

Every single piece is METAL and rust proof.

Operates efficiently on any kind of current used in the home.

Has the same capacity as most of the higher priced washers—SIX SHEETS OR THEIR EQUIVALENT.

UNIVERSAL ELECTRIC CLOTHES WASHER

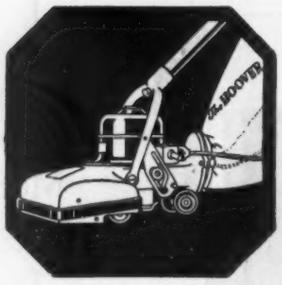
We Want the Best Distributors, Jobbers and Dealers Obtainable in Open Territory

Wire or write today before it is too late

Universal Utilities Corporation

Alpena, Mich.

Hoover Sales Multiplied by Seven—*in two years!*



—And We Can Do Proportionately Well for You

Picture a city of 24,000 composed chiefly of retired farmers; furthermore, a college town without any factories—and you have LaFayette, Indiana.

Nevertheless, in 1918, The Wolever Electric Company of that city sold about 5 or 6 Hoovers a month. Along in the spring of 1919, however, they decided to avail themselves of *all* our help and experience.

This readiness to co-operate fully is all we ask of any dealer—*of you!* In this instance the sales average was increased to about 25 Hoovers a month for the remainder of 1919.

And for 1920 we have co-operated so well that sales have hovered around an average of about 40 Hoovers a month to date—seven times the business they did two years ago.

Now we are ready to give more dealers this same, continuous, on-the-ground, successful merchandising assistance.

Small stocks, rapid turnovers, small floor space, excellent profits, constantly growing volume of sales, the attraction of new customers to your store—all these are factors uppermost in our plan of co-operation that we desire you to hear.

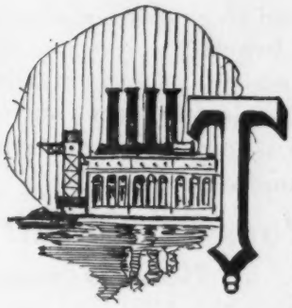
When may the Hoover representative in your district have an appointment with you? His visit will prove to be time well invested on your part, we assure you.

THE HOOVER SUCTION SWEEPER COMPANY, NORTH CANTON, OHIO
The oldest and largest makers of electric cleaners
The Hoover is also made in Canada, at Hamilton, Ontario

The HOOVER

It *Beats* . . . as it Sweeps as it Cleans

Central-Station development is the thermometer that indicates the degree of prosperity of the entire electrical industry



THERE is a lot of loose talk in the country today regarding the public utility. If allowed to go on unchallenged it is going to make this *thermometer* register lower and lower.

It is to your interest, as a part of the electrical industry, sharing in its prosperity, to do your part to stop this knocking by the uninformed public, politicians, demagogues, and radicals. *Do everything you can to boost for the lighting company in your locality.*

If you are a manufacturer see that your employees know the true facts. Ask them to pass the good word on to their acquaintances.

If you are a user of local advertising, use a part of your space to tell the public some true facts about your Central Stations.

This movement is a part of your duty which when performed will bring favorable results to you in some way. It will help the Central Stations to sell their securities, and give them the public cooperation that is badly needed. This in turn will bring about a healthy growth in this phase of the industry that will be reflected in the whole industry.

If you want some facts regarding the Central Station industry of the country, write to us. We shall see that you are supplied.

JEFFERY-DEWITT INSULATOR CO.

Huntington, W. Va., U. S. A.

Pioneer Manufacturers of Thick Cementless Disc Insulators

New York 30 Church St.
Boston 176 Federal St.
Birmingham 237 Brown-Marx Bldg.
St. Paul Pioneer Bldg.
Foreign Offices
Des Moines Hubbell Bldg.
Seattle 526 First Ave. S.
San Francisco 183 First St.
Los Angeles 330 Azusa St.

IRVINGTON VARNISHED CAMBRIC

is woven from specially selected long fibre cotton.

The fabric is treated in our own bleachery by a special process which gives it a smooth uniform finish, increases its insulation value and mechanical strength.

Uniform coatings of any desired thickness are obtained by treatment in our own specially designed towers.

Irvington Insulation in silk, cotton or paper in punched form, washers, tubing or odd shapes can be supplied to meet your requirements.

Our increased facilities enable us to make prompt shipments of orders.

Samples and data on request.

Six Factors of Quality

High Dielectric Strength

Added protection for the same construction.

High Resistance

Leakage reduced to minimum.

Flexibility

The flexible nature of the material increases speed and efficiency of production without reduction of standards.

Non-Hygroscopic

Leakage attendant upon atmospheric changes eliminated.

Heat Resisting

Not affected by working temperatures.

Chemically Neutral

Does not affect and is not affected by impregnating compounds or varnishes.

IRVINGTON PRODUCTS

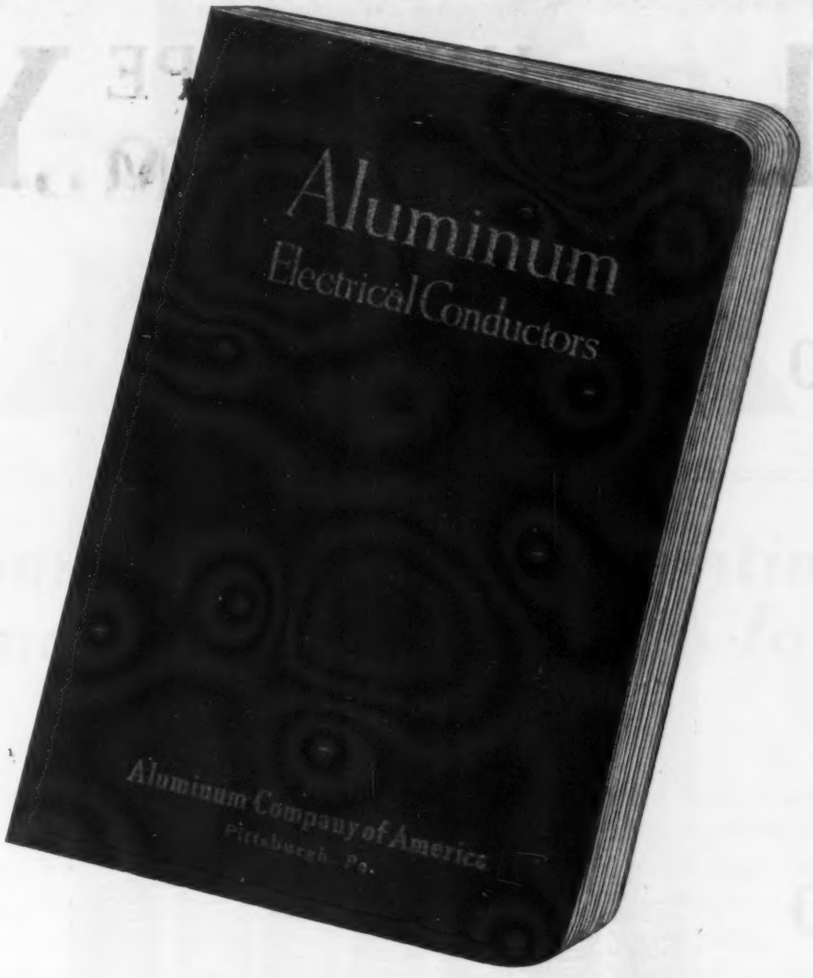
Oiled Silk, Varnished Paper, Black and Yellow Varnished Cambric, Flexible Varnished Tubing, Special Folded Paper for Coil Windings, Insulating Varnishes.

Distributers:

MITCHELL-RAND MFG. CO., New York City
L. L. FLEIG & CO., Chicago
ELECTRIC RAILWAY & MANUFACTURERS SUPPLY CO., San Francisco
T. C. WHITE ELECTRICAL SUPPLY CO., St. Louis
CONSUMERS RUBBER CO., Cleveland

TRADE MARK
Reg. U. S Pat. Off.

IRVINGTON VARNISH & INSULATOR CO.
Irvington, New Jersey.
Established 1905



The New Edition of our Electrical Conductor Handbook has just recently appeared. It contains new tables and data which are of value to those interested in electrical transmission.

The corner coupon, filled out and mailed to us, will bring you the Handbook for your reference library.

Aluminum Company of America,
2400 Oliver Building,
Pittsburgh, Pa.

Please send me without charge or obligation, the New Edition, Electrical Conductor Handbook.

Name).....

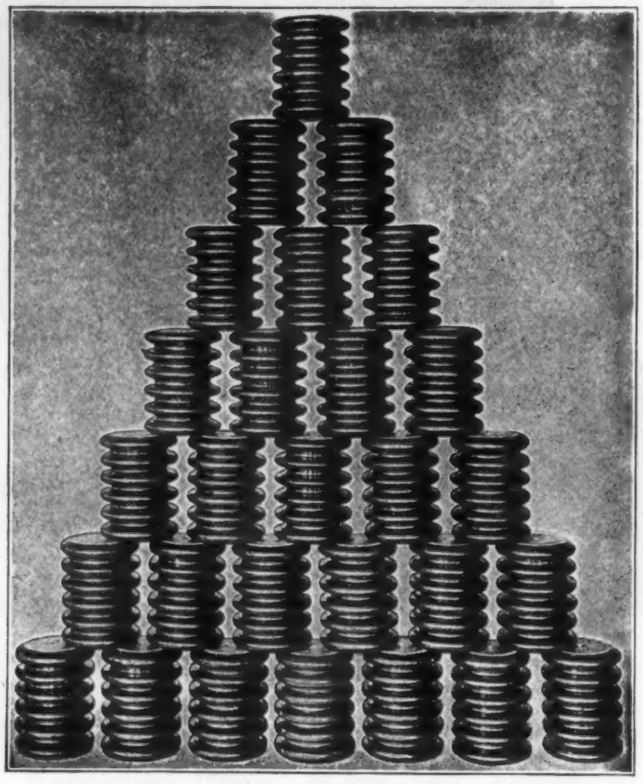
(Address).....

E. W.

HIGH TENSION EQUIPMENT

What UNIT TYPE MEANS TO You

7000 7000



7000 7000

UNIT TYPE BUS BAR SUPPORT INSULATORS

UNIT-TYPE means that with these insulators and our complete line of fittings you can make up over 7,000 bus support combinations. It means that you can with standard stock parts meet any condition that may arise.

THERE are Unit-type bases for clamping to pipe, to I-beams, for bolting to flat surface, etc. There are clamps for use with round bus, for flat bus held in either horizontal or vertical position.

WITH Unit-type you can increase the capacity of buses by placing more bars in position—or use an entirely different size. You can increase the voltage rating by adding unit insulators to the original assembly—see Fig. 6, page 6, DELTA-STAR Bulletin 31.

THE Unit-type idea is simple. Briefly stated, you take standard stock parts, screw them together in the form you wish—instead of using ordinary bus supports designed for a single purpose. Begin now to use Unit-Type.

Delta-Star Electric Company

2433-59 Fulton St., Chicago, Ill.

New York, N. Y., 25 Broad St.
Boston, Mass., 76 Pearl St.
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Syracuse, N. Y., City Bank Bldg.
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St. Louis, Mo., Railway Exchange
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Toronto, Ont., 67 Yonge St.
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Philadelphia, Pa., 1333 Real Estate Trust
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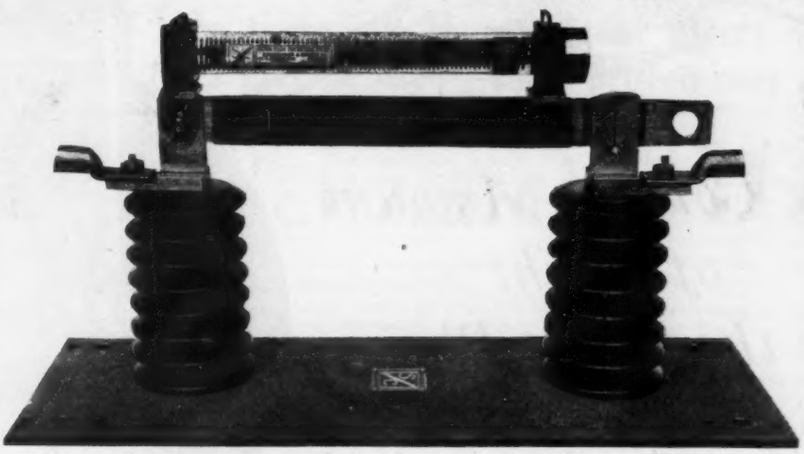
Pittsburgh, Pa., Union Arcade
Soc. Francaise Ohio Brass & Electric, 7 rue de Tilsitt, Paris, France.
A/S Kraftoverforing, Kristiania, Norway.

DELTA-STAR HIGH TENSION EQUIPMENT

UNIT-TYPE INTERCHANGEABLE PARTS



25,000 Volt Type KC Fused Disconnecting Switch.

Combination Fuse Mounting and Disconnect Switch for Limited Space

The Fused Switch shown is furnished for those installations where it is desired to install a combination Disconnecting Switch and Fuse Mounting, but where the space is so limited that the regular types cannot be used. As will be seen, the middle portion of the disconnecting blade is replaced by two pieces of Bakelized insulating material, and the fuse is mounted across this insulated gap so that the current is carried through the fuse. The fuse is mounted in regular fuse clips with the regular retaining bales, so that no difficulty is encountered in the opening and closing of the blade.

The great saving in space will be evident at once, the total space being only slightly more than half of that taken by a regular combination Fuse Mounting and Disconnecting Switch. This type is recommended only for indoor use, and can be furnished in any of the arrangements for front and back connection.

You should know more about the many advantages of

S&C High Potential Fuses

Write for complete data.

District Offices

New York: 30 Church St., Room 432
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Minneapolis: 1124 Metropolitan Life Bldg.
Denver: Denham Building
Seattle: Hoge Building
Los Angeles: 207 I. W. Hellman Bldg.
Winnipeg, Man., Canada: 703 Confederation Life Bldg.
Toronto, Ont.—Traders Bank Bldg.

SCHWEITZER CONRAD, INC.

4435 RAVENSWOOD AVENUE CHICAGO, ILLINOIS U.S.A.

The Correct Amount of Light in the Right Place

Recent developments in the science of industrial lighting have shown the value of carefully planned fixtures and installations. In many shops and factories general lighting by means of ceiling fixtures must be supplemented by individual and local lights for each table, machine or workman.

For this purpose the Anderson Reelite, the "Flexible" lighting unit has been developed. It provides a light on a cord, which can be taken directly to the work, easily adjusted to any position, and which is certain to be put back out of harm's way when the workman has finished with it.

It is so easy to take the lamp wherever it may be needed, hang it right over the work, and then reel in the cord again that the lamp and cord are never left lying around.

Reelite makes individual local lighting so convenient and so easily adapted to any requirement, that the problem of factory and shop lighting is readily solved by their installation. A complete description of the original features of Reelite will be sent on request.

Anderson Electric and Equipment Co.
154-160 Whiting St, Chicago, Ill.

Reelite

Any standard shade or guard can be attached to the socket to meet individual requirements.

Aside from 100 other uses there are thousands of places where *C-H Electric Space Heaters* may be used—some proven uses are indicated

Heating Office and Charging Batteries

"We have a 500 Volt D. C. line into our place of business and several of the employes have cars which have storage batteries that need charging from time to time. Well, we got together and talked about harnessing the 500 Volt circuit. We had some C-H Space Heaters so here is what we did:—By using five heaters we obtained five amperes. Added five more heaters hooked in multiple which gave us a little less than ten amperes.

We found that by using the Space Heaters in this way we could kill two birds with one stone, i. e., heat the office and at the same time charge our batteries."

Electric Locomotives

"We are using C-H Space Heaters to prevent moisture from getting in the motors and electrical wiring of our electric locomotives by placing six or more heaters on a rack under the locomotives. The power is applied when the locomotives are at rest in wet places in the tunnels."

Oil Switches

"The oil switch inspector of a New England Power Co., had considerable trouble with condensation of moisture in our switches of the 110,000 volt type, until a C-H Heater was used to keep the temperature uniform."

Drying Out Transformer Cores and Motors

"An asbestos lined box made of sheet steel in which we will place about thirty Space Heaters properly connected to switches so as to be able to get different heats, and so designed that when used with a small blower all the air passing through the box will pass over all the space heater surfaces. We anticipate using this air heater and blower for drying out transformer cores on the floor under canvas, large motors; and in fact, anywhere where a steady current of hot air (about 90 degrees Cent.) is necessary."

High Tension Lighting Arresters

"We have built houses over our 80,000 volt lightning arresters to protect them from freezing and were somewhat puzzled as how to heat the buildings until we thought of your Space Heaters. So we placed three in each house and these keep the solution from freezing and keep the arresters in operative condition."

Protection of Underground Motor and Generator Against Precipitation of Moisture

"In several of our underground pumping stations the atmosphere is close to the dew point at all times. As the normal underground temperature is approximately 55 degrees Fahr., any slight change in ventilation in the winter frequently causes a considerable precipitation of moisture on everything in the pump station. In our two dampest pump stations we are using C-H Electric Space Heaters under the motor, there being a space of approximately three-quarters of an inch in height from the under surface of the motor frame to the top of the bed plate. This heater is in service at all times, and, when the motor is not running, it is covered with a box made of No. 22 gauge galvanized iron.

We are using a similar arrangement on some of our large underground motors. The C-H Space Heater is the only one we have with cross section small enough to go into the limited space under our centrifugal pump motors."

In Electrical Laboratory Work

"In electrical engineering it is often necessary to determine temperature coefficient and heating effects on certain apparatus. With four C-H Heaters fairly distributed degrees of heat are obtainable. Thus substantial apparatus is obtained for this purpose at a minimum of expense. Since they are compact and stand rough handling they lend themselves well for laboratory work."

Transformer Rooms, Repair Shop, Lavatories

"We use four Heaters in series on 440 volts, to heat our transformer rooms, repair shop, and lavatories. They make good heaters at a reasonable price."

Substation Heating

"The United Illuminating Co., for whom I work, uses Space Heaters to make work in their substations comfortable."

Power House and Office Heating

"For your information, we use quite a number of these Space Heaters for heating our power house, as well as our office uptown."

At the Gatun Hydro-Electric Station, Panama Canal

"Space Heaters are used at the Gatun Hydro-Electric Station, Panama Canal, in the generators whenever they are shut down, to maintain a temperature sufficient to prevent the insulation from absorbing moisture from the surrounding air. They are permanently mounted on the distance ring of the unit just under the armature winding, 10-500 watt units are used. The use of these heaters as above mentioned has proved very satisfactory."

Time Clock

"One of these Space Heaters has proven its merits in a Cincinnati Time Recording Clock which was exposed to cold and damp weather."

Drying Telephone Switchboards, And Load Testing

"I have used C-H Heaters successfully for drying out telephone switchboards. I find them very convenient also for providing artificial testing loads in blocks of 5 amperes."

Armature Test Work

"I have a good and wide range of use for your Space Heaters, in an armature test arrangement connected to a rheostat face. This also gives the best range of current for general tests that I have found yet."

Resistor Capacity For Armature Testing

"While in charge of a Motor Department, we had a large armature to rewind and trying to test it out found that our lamp banks did not have current capacity enough to give our Mils ammeter sufficient throw on the scales. So we rigged up six C-H Heaters in connection with one lamp bank and it did the trick O. K."

Temporary Resistor

"At Sea Breeze, N. Y., while with a Construction Co., we had to wire for an air compressor connected with water system and when the outfit came it had a 110 volt single phase 1 H. P. motor and we had wired for a 220 volt motor as our instruction called for. As they wanted to use the water system at once we used two of your Heaters as temporary resistance and the motor ran for about five weeks in this manner until a 220 volt motor was sent out from the manufacturer at which time we changed the motors and took out the heaters. It ran satisfactorily in every respect and the heaters were mounted direct to the wall with screws and on porcelain insulators with asbestos under them."

Emergency Resistors

"I have at various times had occasion to use C-H Space Heaters to my entire satisfaction I have used them both singly and in parallel for getting any desired value of current. Occasion often arises to use them in repairing broken down resistances and also for controlling the speed of motors. Their compact construction makes it possible to install them in emergency cases and also on permanent jobs and they have proven to be a great help to me."

Miscellaneous Applications in and About Electric Water Power Plants

"We have found C-H Electric Heaters very useful installed in the cast iron tubes which house the floats operating our Head and Tail Race Gauges. Due to the severe climate here these floats would be frozen fast at times if it were not for electric heaters installed along the sides of the casing, which keeps the temperature above freezing point." * * * *

"C-H Electric Space Heaters placed in front of headgates keep the ice from forming, thus allowing the gates to be raised or lowered at any time during the winter."

* * * *

"Space Heaters replace carbon lamps which we have been using in the past to keep the headgates at the intake of our electric power development at Chasm Falls, N. Y. from freezing up and the success we have had with the lamps has suggested the use of your Space Heaters for the same purpose." * * * *

"We also will place one or two of these heaters in the opening at the top of the air-vent leading to our penstock to keep ice from forming, so that there will be no danger of the pipe collapsing in case of an obstruction to the water at the racks."

* * * *

"We have eleven air relief valve houses along our two and a half miles of penstock in which we use C-H Space Heaters to keep the valves from freezing."

Attached to Washing Machines

"Attaching a C-H Electric Space Heater to my Laundryette electric washing machine keeps the water hot." * * * *

The new Booklet "Dictionary of Uses" C-H Electric Space Heaters" should be in your files.

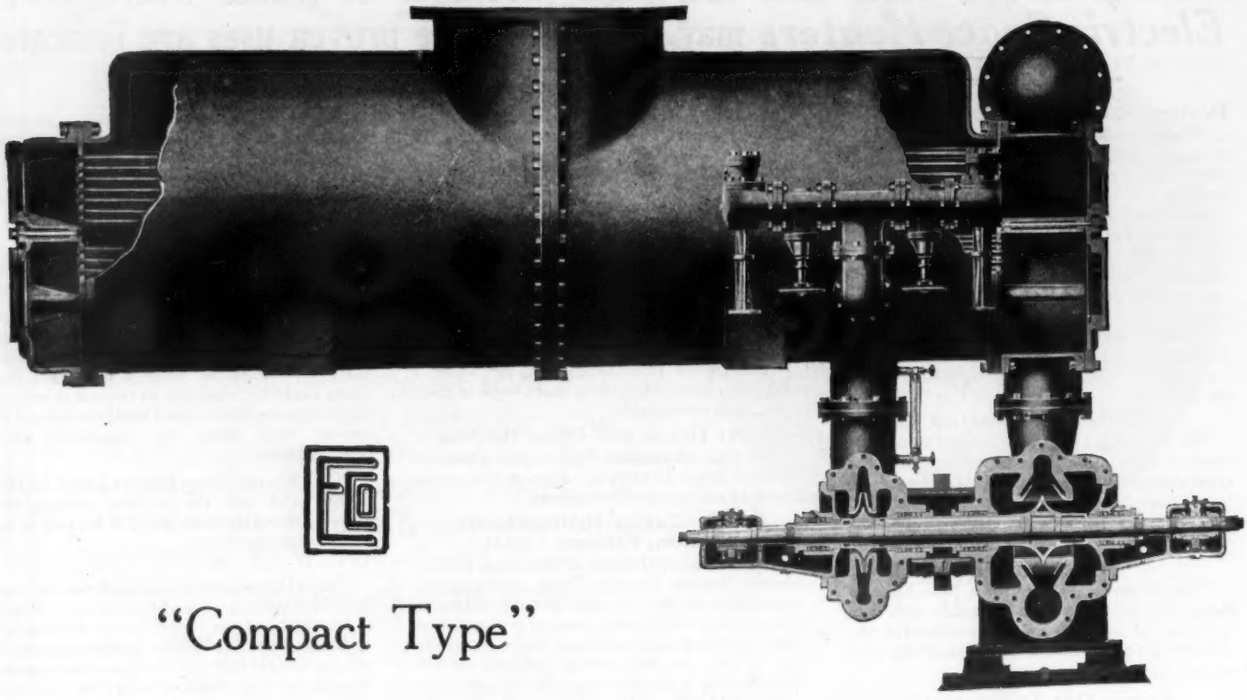
The Cutler-Hammer Mfg. Co.

Works:
MILWAUKEE and NEW YORK

Offices:
New York, Chicago, Boston, Philadelphia, Pittsburg, Cleveland, Cincinnati, Detroit, San Francisco, Los Angeles, Seattle, Birmingham.

"Two Feet of Electrical Heat"

If your Electrical Supply Jobber has no stock write to the Cutler-Hammer District Office nearest you for prompt attention



"Compact Type"

ELLIOTT EHRHART SURFACE CONDENSERS

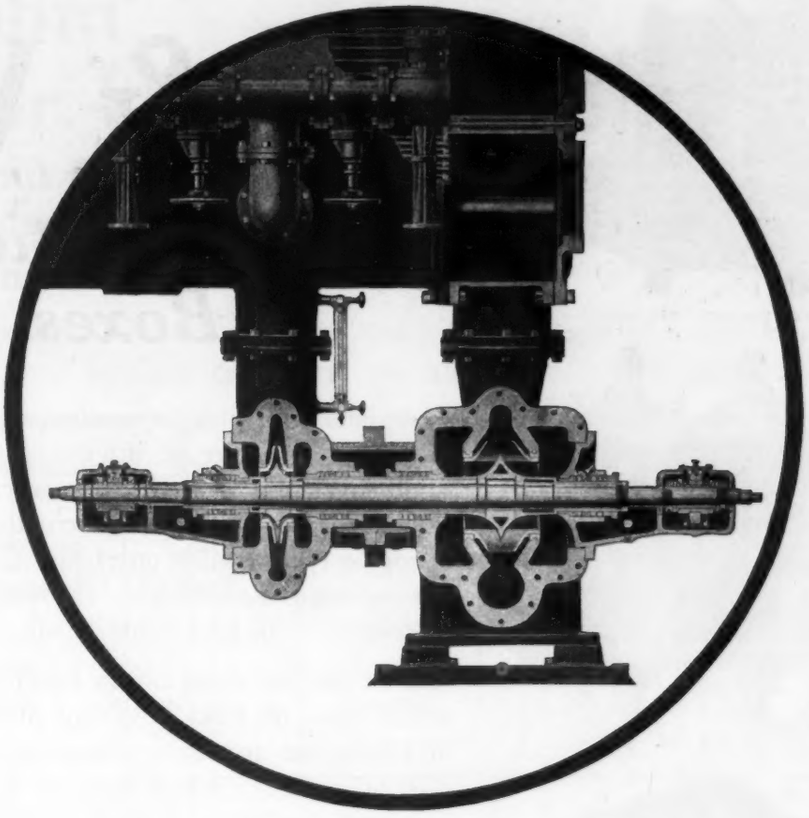
The Elliott Company designs and builds Condensers of all types—Jet, Surface and Barometric—so that without partiality to any one type, Condensers can be furnished which will be best suited to any plant conditions.

When you are in the market for Condensers, let us tell you about Elliott-Ehrhart Condensers. Literature will be sent to anyone on request.

ELLIOTT COMPANY

Pittsburgh, Pa.

GENERAL SALES OFFICES: JEANNETTE, PA.

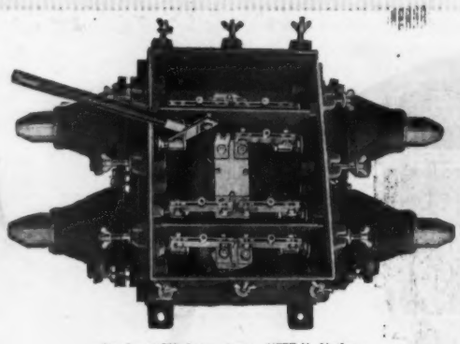


—*the split pump casing!*

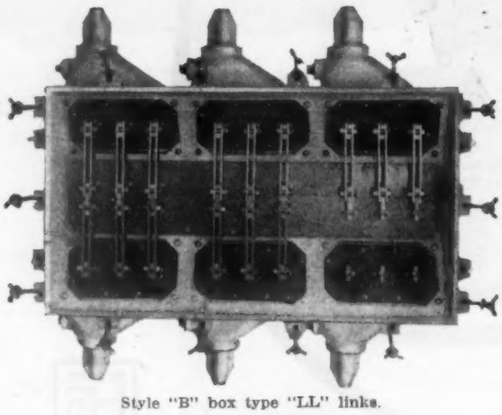
A study of the enlarged view will reveal some very interesting developments in Surface Condenser design.

The condensate and circulating pumps are both mounted on the same shaft. They occupy a minimum of space and may both be driven by the same turbine. The drive can be from either end of the shaft, so that in installations where space is limited, the turbine can be placed underneath Condenser shell. In installations where the heat balance favors a combination turbine and motor drive, the turbine can be located at one end of the pump shaft and the motor at the other.

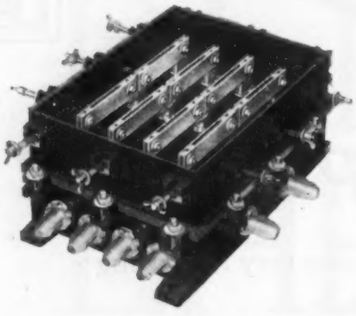
The split pump casing permits the pumps to be inspected and put back in operation in an hour or two instead of the usual day or two. Anyone who has had occasion to inspect a pump of solid case design will appreciate the advantages of this construction.



Style "C" box type "HL" links.



Style "B" box type "LL" links.



Style "E" box type "LL" links.

Style "B" box type "UU" links.

G & W

Distribution Boxes

Five general styles of construction. Style "A" minimum exposure of interior fittings with only small cover to lift. Style "B" conserves wall space. Style "C" shallow flat construction. Style "D" clamp on type without unit heads for tapping without cutting mains. Style "E"" for single conductor cables, with unit cable heads.

Any of the five styles can be equipped with any of seven types of links covering heavy duty, rapid manipulation and other elements affected by the class of service in which they are to be used. With this great flexibility of stock parts a box "made to measure" for any definite service is only a matter of using the desired assembly.

In addition to distribution boxes there are G & W Junction Boxes, Cut Out Boxes, Tap Boxes, Splice Boxes, Street Pillars and Special Boxes for all classes of underground service.

It is not necessary to have to "get along" with "almost what you want," consult G & W as you plan your work and get "exactly what you want."

G & W ELECTRIC SPECIALTY CO.

Manufacturers of Potheads, detachable and non-detachable; Switching and Distribution Boxes; Overhead and Underground Distribution Specialties

7440 So. Chicago Ave., Chicago, Ill.

SALES REPRESENTATIVES IN THE LARGER CITIES

G & W

DISTRIBUTION ENGINEERS

MANUFACTURERS OF DISTRIBUTION SPECIALTIES

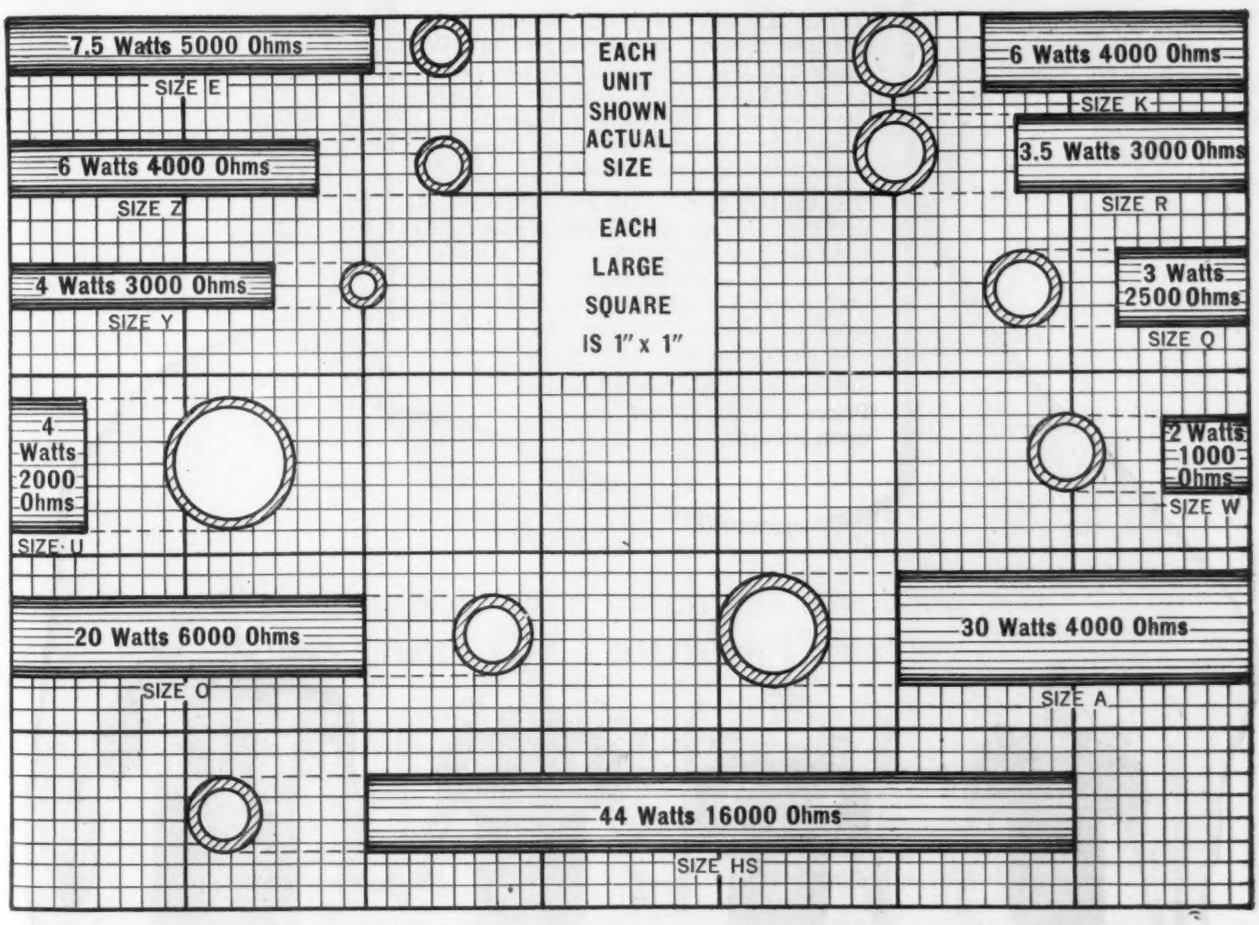
A Few Sizes of

"Vitrohm" Resistor Units

With Vitreous Enamelled Insulation, Are Shown Below

Do You Want One—Free?

Vitrohm, vitreous enamel completely seals the resistance element against corrosion or atmospheric disintegration.



If none of these units meet your requirements, tell us your problem —the experience of our engineering staff is at your disposal.

Ward Leonard Electric Company

LOCATED 150 FEET NORTH OF NEW YORK CITY, IN

MOUNT VERNON NEW YORK

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2019A

Westburg Engineering Co.—Chicago
Electric Material Co.—San Francisco
Electrical Specialties Co.—Detroit
Geo. W. Pieksen—St. Louis

D&W OIL-FUSE CUT-OUTS

Subway Types

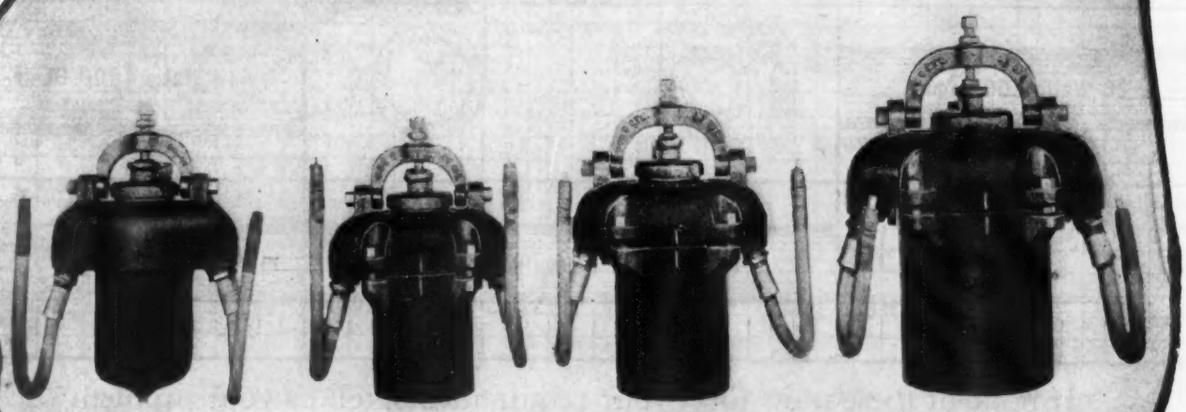
Oil Fuse Cutouts have successfully overcome two inherent weaknesses that other forms of underground primary protective devices possess: namely, unreliability of enclosed fuses, and the length of time required in re-fusing. The Subway type is positive in its operation, reduces repair and shutdown costs, and can be re-fused in a few minutes time.

These Cutouts have been subjected to the most severe tests. In one test, D & W opened 22,000 KVA, namely, 2,000 amperes at 11,000 volts. Another at 1,000 amperes at 2,500 volts submerged in Long Island Sound was given in which perfect results were obtained.

The subway type of Oil Fuse Cutouts is made on the same principle as the Pole type used by Central Stations for many years. It is designed particularly for all underground work and is made in six sizes: 50, 100 and 200 amperes Standard and Heavy Service types at 2,500 volts.

Subway types are carried in stock. Prices will be quoted upon request.

"Oil Fuse Cutouts have filled a long felt want in our underground construction work."
—The Flatbush Gas Company



Heavy Service 50 Amperes 2500 Volts

Standard Service 50 Amperes 2500 Volts

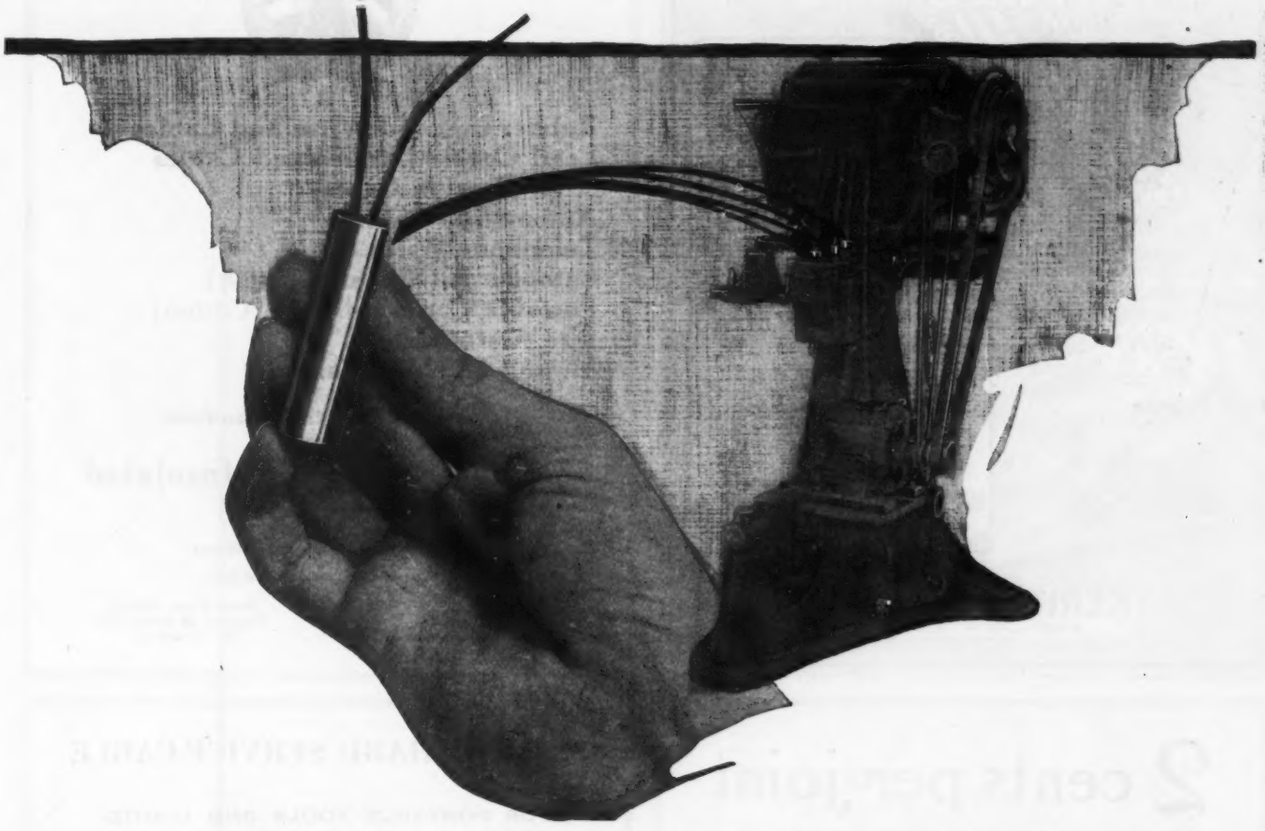
Standard Service 100 Amperes 2500 Volts

Standard Service 200 Amperes 2500 Volts

Fuse D&W Works
of General Electric Company
Providence R.I.

DWC-28

The simplicity of installing and ease of operating electric heating apparatus, are practical reasons for its increasing use in industry.



Thousands of shoe machines are equipped with G-E Cartridge Units

TODAY there are over 100,000 G-E Cartridge Units in daily operation on shoe machines throughout this country. This is not a new application, but a tried and proven adaptation of miniature G-E heating units.

On the machine as shown above the electric unit melts the wax, coats the thread and keeps the thread warm while passing through the machine.

This application only serves to indicate what can be accomplished with modern uses of electric heating. Wherever localized heat is necessary, G-E Electric Units can be applied.

There are thousands of other possible uses. Several are described in Bul'etin 69704.

General Electric Company

General Office Schenectady, N.Y.

Sales Offices in all large cities

39-63

KERITE

AN INVESTMENT

When you put your money into KERITE you make an investment in service. You do more than buy conductors, insulation and protection. You obtain the best possible combination of the most desirable qualities in permanent form.

KERITE remains long after the price is forgotten.

KERITE INSULATED WIRE & CABLE COMPANY
NEW YORK CHICAGO

IF IT'S **PARANITE** IT'S RIGHT

Rubber Covered Wires and Cables
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High Tension Cables
Automobile Cables
Telephone Wires
Lampcords (Silk and Cotton)
Portable Cords (Silk and Cotton)
Fire Alarm Cables
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For 30 Years the Standard

Indiana Rubber and Insulated Wire Co.

Factory and General Offices:
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Thomas & Betts Co.
63 Vesey St.

2 cents per joint

is the cost of materials where OKONITE INSULATING and MANSON FRICTION Tapes are used.

Their use *insures* a perfect joint!

Why experiment and waste high priced labor on inferior tapes?

THE OKONITE COMPANY
Incorporated 1884 PASSAIC, N. J.

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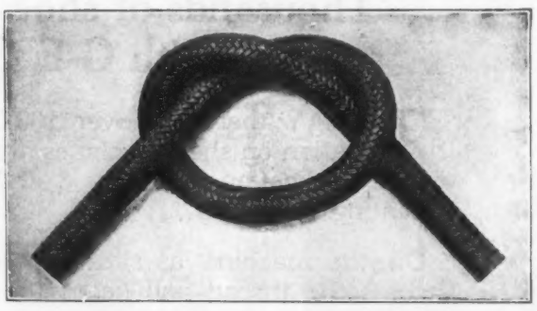
SIMPLEX HARD SERVICE CABLE

FOR PORTABLE TOOLS AND LIGHTS



Flexible as a lamp cord. Protected by a seine twine braid specially treated to withstand rough use. Recommended for portable tools and lights in machine shops, garages, shipyards and on any engineering or construction work where conditions are severe and continuous service is essential.

Send for descriptive circular No. 6.

SIMPLEX WIRE & CABLE Co
MANUFACTURERS
201 DEVONSHIRE ST. BOSTON
CHICAGO SAN FRANCISCO

For the first time in five years the larger Mines, Mills and Factories of the United States find they can take time to do a systematic job of maintenance and repair on their electrical equipment. This situation is reflected in the advertising as well as the editorial pages of this issue of Electrical World. Concerns which make material for electrical repairs are advertising to the 6957 industrial electrical engineers who subscribe in order to cash in on this large accumulated volume of repair work.

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Our Service is constructive betterment applied to industrial plants, aimed to increase production, reduce costs and improve industrial relations.
Our position in our field warrants your consideration.
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Revolving Field, 3-Ph. 60-Cy. Generators

Kva.			Speed
1	50	Crocker-Wheeler, 2300-volt, revolv. field	1200
1	50	Gen. Elec. TRE, 240 or 480-volt, direct con. to New York Safety engine	300
	55	Westinghouse, 2200-v., Alternator, direct connected to 9 x 12-in. McEwen horizontal, tandem compound automatic, self-oiling steam engine	257
2	60	Electric Machinery, revolving field, 2300-volt	900
1	75	Ridgeway, type ATB, 220-volt Alternator, direct connected to 13 x 12-in. Ridgeway steam engine	300
1	75	Gen. Elec. ATB, form PB, 2300-volt, revolv. field	900
1	100	Allis-Chalmers, 1100 or 2200-volt revolv. field	900
1	100	Westinghouse, 2200-volt revolv. field	900
	100	Western Elec. (G. E.), type TRB, 220-volt	900
	100	Ft. Wayne "Wood," type TRB, 2300-volt	900
1	200	Gen. Elec., type ATI, form B, 2300-volt	600
1	300	Westinghouse, 220-volt (3-bearing)	514

250-volt, D.C. Generators

1	5	Willey, MP	1400
1	15	Peerless, MP	900
1	25	Ft. Wayne, 6-pole, type ML	875
1	25	Keystone, MP	725
2	62½	Allis-Chalmers, MP	450
1	75	Northern, 6-pole	525
1	100	Milwaukee, 6-pole	550
2	125	Allis-Chalmers, MP	850
1	150	General Electric, type MPL, form G, interpole 2-bearing	650

500 to 550-volt, D.C. Generators

1	100	General Elec., 6-pole, comp., type MP, form H	600
1	100	Ft. Wayne, 6-pole, type MPL, frame IF, comp., 3-bearing	550
	250	General Electric, 6-pole, type MP, form A	450

220-Volt, D.C. Motors

Hp.			Speed
2	1	General Electric, type CO	1275
1	1	Browning, series, full load speed	1100
1	1	Peerless, interpole, variable speed	440-900
1	2	Imperial, interpole	1800
1	2	Northern, MP	1650
1	2	Northern, MP, series (intermittent duty), crane motor	800
1	3	General Electric, type RC, form A-35, shunt, interpole	1700
1	3	Northern, MP, comp.	600
1	5	Fairbanks-Morse, MP	1150
2	5	Gen Elec, MP type C E	1100
1	5	Crocker-Wheeler, MP, type D	980
2	5	Crocker-Wheeler, form L	980
1	5	National, MP, type NL	950
1	5	Western Elec., MP, type 4P	900
1	5	Watson, MP, type AW3B	850
1	6	Fairbanks-Morse, MP	1400
1	6	Electro-Dynamic, shunt interpole	1050
1	7½	Crocker-Wheeler, form L	1650
1	7½	Sturtevant, MP, type H, form I, comp., interpole	545-1090
1	7½	Gen. Elec., MP, type CR, variable speed,	500-1000
1	10	General Electric, type RC, form A-11, shunt, interpole	1475
1	10	Fairbanks-Morse, type CP, shunt, interpole	1425
1	10	Roth, MP	800
1	15	Sturtevant, MP, form P	975
1	15	Triumph, MP, type M	975
1	15	General Elec., MP	800
1	15	Westinghouse, MP	650
1	20	Fairbanks-Morse, type CP, comp., interpole	900
1	20	Crocker-Wheeler, MP	775
1	20	National, MP, type NL comp	625
1	20	Western Electric, type ELC, shunt, interpole	600
2	20	Westinghouse, type SK (frame 110-L) interpole variable speed	750-1500
1	20	Jenney, MP	575
1	25	Crocker-Wheeler, MP, form I	750
1	25	Western Electric, MP, type 4P, comp. (hexagon frame)	600
1	25	General Electric, type CO, form E, series, crane motor	570
2	27	Sprague-Lundell, 6-pole type RT, series wound	275
1	30	Milwaukee, MP, type	530
1	30	Westinghouse, MP, type M	575
1	35	Gen. Elec., 6-pole, type CL, form B	1100
1	35	Allis-Chalmers, MP	925
1	35	Crocker-Wheeler, MP	700
1	35	Northern, MP	575
1	35	Gen. Elec., type CL, form B, comp., interpole, variable speed, with compound starter	375-850
1	40	Fairbanks-Morse, MP, comp	750
1	40	Northern, MP, comp	650
1	40	Western Electric, MP, type E	625
1	40	National, MP type NL	550
1	45	Allis-Chalmers, MP, comp	650
1	50	National, MP, type NL	750
2	50	Crocker-Wheeler, MP,	570
2	50	Westinghouse, MP, type S, No. 12	525
1	50	Westinghouse, MP, type M	450
1	55	Allis-Chalmers, MP	850
	75	Crocker-Wheeler, MP, type D	550
1	75	Burke 6-pole, comp., interpole	375
3	75	Allis-Chalmers, MP,	325
1	90	Western Elec., 6-pole	525
1	90	General Elec. type CL, 6-pole, shunt, variable	475-600
1	90	Northern, 6-pole, comp	450
1	100	Crocker-Wheeler, MP, type D	660
1	120	Milwaukee, 6-pole,	480
1	125	Westinghouse, type SK, comp., interpole	480
3	150	Allis-Chalmers, MP,	650
1	200	Gen. Elec., type MPL, form G, 6-pole, comp., interpole	500

3-Phase, 60-Cycle Motors 220 or 440 Volt

8	¾	Western Electric (G.E.) type KT-711, form C	1200
1	1	General Electric, type KT-112, form C	1800
3	1	General Electric, type KT-112, form C	1200
1	1	Westinghouse, type CSA	1140
1	1	Gen. Elec., type KT,	900
1	2	Gen. Elec., type KT-122, form C	1800
2	2	Hobart, new (ball bearing)	1705
7	2	Gen. Elec., type KT-730, form C	1200
2	2	Imperial, type SC	1200
2	2	Westinghouse, typeCS	1120
9	3	Gen. Elec., type KT-730, form C	1800
5	3	Hooart, new (ball bearing)	1750
1	3	Westinghouse, type CS	1730
4	3	Gen. Elec., type KT-731, form C	1200
1	3	Lincoln	900
1	5	Gen. Elec., type KT-160, form C	1800
2	5	Triumph,	1800
1	5	Reliance	1800
1	5	Westinghouse, type CS	1735
3	5	Gen. Elec., type KT-180, form C	1200
1	5	Ideal, type A	1150
2	5	Wagner, type 13TBP	1140
1	5	Westinghouse, type CS	675
2	7½	Gen. Elec., type KT-750, form C	1800
1	7½	Wagner, type BP, Model 14T	1720
1	7½	Gen. Elec., type KT-181, form C	1200
1	7½	Wagner, type 14VBP	1140
1	7½	Western Electric (G.E.) type I, form K	720
2	10	Gen. Elec., type KT-751, form C	1800
2	10	Gen. Elec., type KT-732, form C	1200
13	10	Gen. Elec., type KT-302, form B	1200
1	10	Gen. Elec., type KT-302, form B	900
1	10	Western Elec., (G. E.) type KT-312, form C	900
2	10	Wagner, type 19TB, new	600
1	15	Western Elec., (G. E.), type KT-182, form C	1800
7	15	Gen. Elec., type KT-312, form B	1200
1	15	Wagner, type 17TBP	1120
1	15	Otis	900
1	15	Gen. Elec., type I, form M, 220 v., slip-ring, variable speed	900
13	15	Wagner, type 19TBP,	850
2	15	Wagner, type BP, Model 19T	600
2	15	Otis	600
3	15	Burke, type EM	600
2	15	Burke, type EM, (3-bearing for ceiling suspension only)	600
1	20	Western Elec. (G. E.), type KT-312, form B	1200
6	20	Gen. Elec., type KT-322, form B	1200
1	20	Gen. Elec., type KT-322 form B, slip-ring	1200
1	20	Allis-Chalmers, type AN	1160
2	20	Otis	900
2	20	Western Elec., (G. E.), type KT-326, form B	900
1	20	Western Elec. (G. E.), type MT-326, form B, 220 v., new, slip-ring	900
1	20	Wagner, type 19TBP	850
3	25	Gen. Elec., type KT-326, form B	1200
1	25	Wagner, type 19 TBP	1140
1	25	Gen. Elec., type KT-332, form B	900
3	25	Wagner, type 22 TBP	850
1	30	Gen. Elec., type KT-332, form B	1200
1	30	Western Elec., (G.E.) type KT-326, form B	1200
2	30	Gen. Elec., type KT	900
1	30	Gen. Elec., (type I-8-30), form K, 2300 v	900
1	30	Western Elec., (G. E.) type MT, (frame 342), new, 440 v., slip-ring	720
1	30	Westinghouse, type MS (mill type—heavy duty)	560
	35	Gen. Elec. type KT-332, form B	1200
1	40	Gen. Elec., type KT-336, form B	1200
6	40	Gen. Elec., type KT-322, form B	1200
2	50	Gen. Elec., type KT-343, form B	1200
2	50	Western Elec. (G. E.), type KT (frame 343), form B	1200
1	50	Gen. Elec., type KT-346, form B	900
1	50	Western Elec., (G. E.), type I, form K with double shaft extension	900
1	50	Allis-Chalmers, type ANY, slip-ring, new, constant speed	865
2	50	Gen. Elec., type KT, form B, (frame 365)	600
1	60	Otis	1200
2	60	Western Elec. (G. E.) type KT-343, form B	1200
2	60	Western Elec., (G. E.) type KT-346, form B	900
1	75	Gen. Elec., type I, form K	1800
1	75	Gen. Elec., type I, form M, 220 v., slip-ring	900
2	100	Gen Elec., type I,	1800
1	100	Fairbanks-Morse, type B, 2200 v	1200
2	250	Gen. Elec., type I, form K, 550 v	495

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Hp.			Speed
11	¼	110-volt	850
7	¼	220-volt	850
8	1	110-volt	850
17	1	220-volt	850
7	1¼	110-volt	850
8	1¼	220-volt	850
6	2	110-volt	850
6	2	220-volt	850
8	3	110-volt	850
8	3	220-volt	850

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1—15-hp. Gen. Elec., type CE, 1100-r.p.m.
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2—125-kw., 125-volt Allis-Chal., speed 750.
110-kw., 250-volt Westghse., speed 675.
100-kw., 250-volt Allis-Chal., speed 550.
100-kw., 500-volt Western, speed 650.
75-kw., 250-volt Crocker-Wheeler, speed 1150.
50-kw., 250-volt Western, speed 780.
40-kw., 125-volt Western, speed 1150.
37½-kw., 250-volt Crocker-Wheeler, speed 900.
25-kw., 500-volt Western, speed 1350.
300-kw., 575-volt Gen. Elec., dir. conn. Erie Ball Steam Engine.
300-kw., 250-volt Western Elec., dir. conn. Quincy Auto Steam Engine.
200-kw., 500-volt Ridgway, dir, conn. Ridgway, 21 x 22-in. Steam Engine.
200-kw., 250-volt Westghse., dir. conn. Erie Ball Steam Engine.
150-kw., 250-volt Gen. Elec., dir. conn. Harrisburg Fleming Engine.
100-kw., 250-volt Westghse., dir. conn. Skinner Steam Engine.
75-kw., 250-volt Westghse., dir. conn. Erie Ball Steam Engine.
50-kw., 250-volt Crocker-Wheeler, dir. conn. Harrisburg-Fleming Engine.
25-kw., 125/250-volt Ft. Wayne, dir. conn. Sturtevant Vertical Engine.
25-kw., 250-volt Westghse., dir. conn. Erie Ball Steam Engine.

MOTOR GENERATOR SETS

500-kw., 125/250-volt, D.C., 3-ph., 60-cy., 6600-volt, A.C. Gen. Elec. Synch. Motor Generator.
300-kw., 275-volt, D.C., 3-ph., 25-cy., 2300-volt, A.C., Gen. Elec. Synch Motor Generator.
200-kw., 500-volt, D.C., 3-ph., 60-cy., 2300-volt, A.C. Allis-Chalmers Synch. Motor Generator
150-kw., 250-volt, D.C., 3-ph., 60-cy., 2300-volt A.C. Gen. Elec., Synch. Motor Generator.
100-kw., 275-volt, D.C., 3-ph., 60-cy., 2300-volt A.C. Gen. Elec. Rotary Converter.
75-kw., 250-volt, D.C., 3-ph., 60-cy., 440-volt, A.C. Crocker-Wheeler Induction Set.
50-kw., 250-volt, D.C., 3-ph., 60-cy., 440-volt, A.C Westinghouse Induction Set.

ALTERNATING CURRENT MOTORS

2—1000-hp. Gen. Elec., 25-cy., slip ring, speed 00
400-hp. Westghse., 60-cy., slip ring, speed 450.
300-hp. Gen. Elec., 60-cy., slip ring, speed 580.
250-hp. Gen. Elec., 60-cy., slip ring, speed 580.
225-hp. Gen. Elec., 60-cy., slip ring, speed 575.
200-hp. Westghse., 60-cy., slip ring, speed 600.
150-hp. Gen. Elec., 60 cy., Form L, speed 720.
150-hp. Gen. Elec., 25-cy., slip ring, speed 375.
100-hp. Burke, 60-cy., slip ring, speed 720.
75-hp. Burke, 60-cy., slip ring, speed 720.
52-hp. Gen. Elec., 25-cy., slip ring, speed 690.
50-hp. Westghse., 60-cy., slip ring, speed 690.
37-hp. Gen. Elec., 25-cy., slip ring, speed 690.
30-hp. Westghse., 60-cy., slip ring, speed 690.
450-hp. Westghse., 25-cy., sq. cage, speed 360.
300-hp. Westghse., 60-cy., sq. cage, speed 600.
200-hp. Westghse., 60-cy., sq. cage, speed 600.
200-hp. Westghse., 25-cy., sq. cage, speed 500.
200-hp. Westghse., 60-cy., sq. cage, speed 1140.
150-hp. Gen. Elec., 60-cy., sq. cage, speed 600.
100-hp. Allis, 60-cy., sq. cage, speed 1750.
100-hp. Burke, 60-cy., sq. cage, speed 514.
100-hp. Gen. Elec., 60-cy., sq. cage, speed 720.
75-hp. Westghse., 60-cy., sq. cage, speed 690.
6—50-hp. Westghse., 60-cy., sq. cage, speed 850.
50-hp. Western, 60-cy., sq.cage, speed 1200.
4—35-hp. Westghse., 60 -cy., sq. cage, speed 1120.
35-hp. Gen Elec., 25-cy., sq. cage, speed 500.
35-hp. Western, 25-cy., sq. cage, speed 750.
6—25-hp. Westghse., 60-cy., sq. cage, speed 1200.

MOTOR DRIVEN PUMPS

5-in. Lea-Courtney Split Case Turbo Pump, with motor to suit.
5-in. Lea-Courtney Split Case,2-stage Turbo Pump with motor to suit.
8-in. Worthington Split Case Volute Pump, with motor to suit.
8 x 10-in. Gould Vert. Triplex, with 25-hp., 3-ph., 60-cy., 220-volt, G. E. Motor.

MISCELLANEOUS

2—2½-kva., 1-ph., 60-cy., 110-volt Crocker-Wheeler 1800-r.p.m. Generators.
4—15-kw., 3-ph., 60-cy., 220-volt Gen. Elec., 1800-r.p.m. Generators.
25-kw., 3-ph., 60 cy., 220-volt Sprague, 1200-r.p.m. Generator.
8—1-kw., 220-volt, D.C. Gen. Elec., 3-ph., 60-cy. 220-volt, 1800-r.p.m. motor generators.

PITTSBURGH'S ELECTRICAL CLEARING HOUSE

ESTABLISHED 1908

MILLER-OWEN ELECTRIC CO., Inc., LEXINGTON AVE., AND THOMAS BOULEVARD PITTSBURGH, PENNA.

We cordially invite inspection of our new Warehouse, Salesroom and Shop

LARGE EQUIPMENT

READY FOR IMMEDIATE DELIVERY

ALTERNATING CURRENT DIRECT CONNECTED SET

1—450 KVA., 3 phase, 60 cycle, 550 volt, Crocker-Wheeler generator, direct connected to horizontal cross compound Erie City Lentz engine, size 15½ x 26 x 18, 200 r.p.m. Complete with all parts ready to operate; practically new. Installed in 1912.

ALTERNATING CURRENT BELTED GENERATORS

1—50 KVA, 2 phase, 60 cycle, 1150 volts Crocker-Wheeler revolving field generator.
1—50 KW., 3 ph., 60 cycle, 2300 volt, G. E., 1200 r.p.m., Type A.T.B. Can reconnect to lower voltage.
1—75 KW, 3 phase, 60 cycle, 2200 volt, 720 r.p.m., revolving armature.
1—75 KW, 3 phase, 60 cycle, 240/480 volt, 900 r.p.m., General Electric, Type ATB.
1—100 KW, 3 phase, 60 cycle, 2300 volt, 900 r.p.m., General Electric, type ATB.
1—150 KVA., 3 phase, 60 cycle, 240/480 volt, 600 r.p.m. Crocker-Wheeler, revolving field.
1—180 KW, 3 phase, 60 cycle, 440 volt, 514 r.p.m., Westinghouse revolving armature.
1—250 KW., 3 phase, 60 cycle, 6600 volt, 300 r.p.m., General Electric, type ATB, revolving field. Can be stepped down to lower voltages.
1—600 KW, 3 phase, 60 cycle, 6600 volt, 300 r.p.m., General Electric, type ATB, revolving field. Can be stepped down to lower voltages.

DIRECT CURRENT BELTED GENERATOR

1—450 KW, 250 volt, 8 pole C & C direct current generator.

LARGE HEAVY DUTY CORLISS ENGINES

1—26-in. x 48-in. heavy duty Allis Corliss engine, in splendid condition.
1—18 x 36-in. heavy duty Fishill Company Engine.

ROTARY CONVERTERS

2—300 KW, 3 phase, 25 cycle, 600 volt, D.C. operation, complete with transformers.

LARGE ALTERNATING CURRENT MOTORS

1—300 hp. 3 phase, 60 cycle, 550 volt, 600 r.p.m., Crocker-Wheeler, 3 bearing slipring.
1—200 hp. 3 phase, 60 cycle, 220/440 volt, 600 r.p.m., new General Electric slipring.
1—200 hp. 3 phase, 60 cycle, 550 volt, 900 r.p.m., Lincoln Electric Co. squirrel cage motor.
1—150 hp. 3 phase, 60 cycle, 550 volt, 600 r.p.m., new General Electric slipring.
1—150 hp. 3 phase, 60 cycle, 550 volt, 720 r.p.m., new General Electric slipring.
2—150 hp. 3 phase, 60 cycle, 220/440 volt, 600 r.p.m., Westinghouse, type CS.
1—150 hp. 3 phase, 60 cycle, 220/440 volt, 720 r.p.m. new General Electric slipring.
1—150 hp. 3 phase, 60 cycle, 220/440 volt, 600 r.p.m. new General Electric slipring.
2—100 hp. 3 phase, 60 cycle, 220/440 volt, 900 r.p.m., new General Electric slipring.
1—100 hp. 3 phase, 60 cycle, 220/440 volt, 720 r.p.m., new General Electric slipring.
2—100 hp. 3 phase, 60 cycle, 550 volt, 900 r.p.m. and 720 r.p.m., new General Electric slipring.

Also a Large Stock of Smaller Sizes.

SYNCHRONOUS MOTOR

1—200 hp. 3 phase, 60 cycle, 2300 volt, 600 r.p.m., General Electric, type ATI, revolving field synchronous motor, complete with compensator and starting panel.

ALTERNATING CURRENT TURBINE SET

1—100 KW, 3 phase, 60 cycle, 240/480 volt, General Electric, type ATB, 3600 r.p.m., form P to Curtiss turbine.

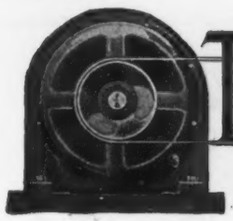
LARGE ALTERNATING CURRENT GENERATORS FOR WATERWHEEL DRIVE OR SYNCHRONOUS MOTOR FOR DIRECT CONNECTION

2—550 KW, 3 phase, 60 cycle, 240/480 volt, 171 r.p.m., General Electric, revolving field. 85% power factor.

DIRECT CURRENT—3 WIRE TURBINE UNIT

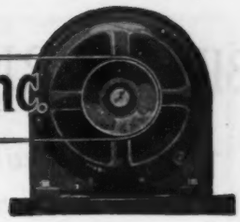
1—150 hp. De Laval Turbine, direct connected to 100 KW, 125/250 volts, direct current Sprague generator.

JOSEPH MYERSON, 411 Atlantic Ave., Boston 9, Mass.



TIFFANY HALL & CO., Inc.

ELECTRICAL EQUIPMENT - ENGINEERS



IN STOCK—MOTORS

F. O. B. Hoboken—*Prompt Shipment*

Stock No.	Hp.	Volts	Speed	Ph.	Cy.	Make and Type
1	350	440	400	3	60	G. E. 3-bearing synchronous
2596	350	220/440	500	3	25	Burke, 3-bearing, slip ring
2595	300	220/440	500	3	25	G. E. "M", 3-bearing, slip ring
2594	300	220/440	500	3	25	G. E. "M", 3-bearing, slip ring
2525	250	440	500	3	25	General Electric Slip ring.
2396	200	230	475	DC	DC	Sprague, Gen. Elec.
2640	200	440	580	3	60	Allis-Chalmers, slip ring
2589	200	220/440	500	3	25	G. E. "M" 3-bearing, slip ring
2588	200	220/440	500	3	25	G. E. "M" 3-bearing, slip ring
2587	200	220/440	500	3	25	G. E. "M" 3-bearing, slip ring
2035	150	220/440	600	3	60	Western Elec., sq. cage
1842	150	220/440	600	3	60	Crocker-Wheeler, slip ring
2000	125	2200	600	3	60	Western Elec., sq. cage
2674-A	125	125	650	DC	DC	General Electric MP
2041	125	550	600	3	60	Western Elec. sq. cage
2003	125	2200	600	3	60	Western Elec., sq cage..
2578	100	440	750	3	25	Westinghouse CCL, sq. cage
2579	100	440	500	3	25	Gen Elec. I., wound motor
1997	100	2200	600	3	60	Western Elec., sq. cage
2047	100	2200	720	3	60	Western Electric., sq cage
2296	100	220/440	1200	3	60	Gen. Elec. K, sq. cage
2654	75	220/440	900	3	60	General Elec. M., slip ring
2655	75	220/440	900	3	60	General Elec. M., slip ring
2656	75	220/440	900	3	60	General Elec. M slip ring
2670	52	220/440	500	3	25	G. E. "M" slip ring
2671	52	220/440	500	3	25	G. E. "M" slip ring
1975	75	2200	870	3	60	Western Elec. sq cage
2574	40	220/440	750	3	25	General Elec. K., sq. cage
2575	40	220/440	750	3	25	Burke EM, sq. cage
2504	40	440	600	3	60	Gen. Elec. KT (50 deg. C.)
2670-A	40	220/440	500	3	25	G. E. "M", slip ring
2671-A	40	220/440	500	3	25	G. E. "M", slip ring
2504	40	220/440	600	3	60	G. E. I sq. cage
2659	35	220/440	900	3	60	General Elec. M slip ring
2660	35	220/440	900	3	60	General Elec. M slip ring
2661	35	220/440	900	3	60	General Elec. M slip ring

Stock No.	Hp.	Volts	Speed	Ph.	Cy.	Make and Type
2529	35	220/440	1150	3	60	Crocker-Wheeler, sq. cage
2317	30	115	525	DC	DC	Westinghouse
2491	30	230	965	DC	DC	Gen. Elec. CLB
2382	30	440	600	3	60	Gen. Elec. KT (50 deg. C.)
2387	30	220	900	3	60	Gen. Elec. KT (50 deg. C.)
2430	30	440	1200	3	60	Gen. Elec. KT (50 deg. C.)
2431	30	440	1200	3	60	Gen. Elec. KT (50 deg. C.)
2433	30	440	1200	3	60	Gen. Elec. KT (50 deg. C.)
2437	30	440	1200	3	60	Westinghouse CS (50 deg. C.)
2438	30	440	1200	3	60	Westinghouse CS (50 deg. C.)
2439	30	440	1200	3	60	Westinghouse CS (50 deg. C.)
2508	30	440	600	3	60	Gen .Elec. KT (50 deg. C.)
2509	30	440	600	3	60	Gen. Elec. KT (50 deg. C.)
2426	30	220/440	1200	3	60	Westinghouse CX (50 deg. C.)
2427	30	220/440	1200	3	60	Westinghouse CX (50 deg. C.)
1969	30	2200	900	3	60	Western Elec., sq. cage
2573	25	220/440	720	3	25	Burke EM, sq. cage
2605	25	220/440	720	3	25	Westinghouse CX, sq. cage
2358	25	220/440	1200	2	60	Westinghouse CCL, sq. cage
2490	25	230	635	DC	DC	Gen Elec. CLB
2332	25	115	1050	DC	DC	Allis-Chalmers, Bullock
2130	20	230	775	DC	DC	Crocker-Wheeler type
2567	20	220/440	720	3	25	Gen. Elec. KT, sq. cage
2636	15	220	900	3	60	Gen. Elec. form L
2599	15	220/440	720	3	25	Westinghouse type B
2558	13	220/440	720	3	25	Burke EM, sq. cage
2555	10	220/440	720	3	25	Fairbanks Morse B, sq cage
2647	10	220	1120	2	60	Westinghouse CCL, sq. cage
2553	7½	220/440	720	3	25	Burke EM sq. cage
2552	5½	220/440	720	3	25	Burke EM, sq. cage
2637	5	220	1200	3	60	Gen. Elec. form L
2518	5	220/440	600	3	60	Gen. Elec. KT, sq. cage
2538	5	220/440	720	3	25	Burke EM., sq. cage
2540	5	220/440	720	3	25	Burke EM, sq. cage
1503	15	115	875	DC	DC	Westinghouse, type S
2518	5	220/440	600	3	60	Gen. Elec. KT, sq. cage
2303	5	110	950	DC	DC	Northern-Gen. Elec.
2305	5	110	950	DC	DC	Northern-Gen. Elec.

MOTOR GENERATOR SETS

One 200-kw., 250-volt, 580-r.p.m., direct current, compound wound Sprague General Electric, 6-pole Generator, complete with field rheostat and direct connected with flexible coupling to 300 hp., 2200-volt, 580-r.p.m. 3-phase, 60-cycle G. E. form K, squirrel cage motor with starting apparatus.

One 100-kw., 600-r.p.m., 125/250-volt, 3-wire Westinghouse Generator direct connected to and mounted on same base with 150-hp., 3-ph., 60-cycle, 220 or 440-volt, Westinghouse squirrel cage motor complete.

One 75-kw. Set consisting of 75-kw., 1150-r.p.m., 125-volt, direct current, compound wound Sprague-General Electric type LB Generator, complete with field rheostat, and direct connected by means of flexible coupling, with 100-hp., 220/440-volt, 1150-r.p.m., 3-phase, 60-cycle, General Electric, form K motor, with starting apparatus. 1 *week shipment.*

BELTED A. C. GENERATORS

2110—One 200-kw., 2300-volt, 600-r.p.m., 3-phase, 60-cycle, Westinghouse revolving field, complete with base, pulley, belted exciter and rheostat. 3 *weeks.*

2500—200-kw., 600-r.p.m., 2300-volt, 3-phase, 60-cycl · Allis-Chalmers-Bullock revolving field, with direct connected exciter, base, pulley and field rheostat. 1 *week.*

2634—One 150-kw., 600-r.p.m., 230-volt, 3-phase, 60-cycle, General Electric A-T-B, form P, rev. field belted alternating current generator, complete. 2 *weeks.*

S2634—One 150-kw., 600-r.p.m., 220-volt, 3-phase, 60-cycle General Electric form P Belted Generator.

2499—One 140-kva., 720-r.p.m., 2300-volt, 3-phase, 60-cycle Westinghouse revolving field type Alternator, with exciter, pulley base and field rheostat. 3 *weeks.*

2501—One 100-kw., 900-r.p.m., 2300-volt, 3-phase, 60-cycle Allis-Chalmers Bullock revolving field, complete with field rheostat, pulley, base and belted exciter. 3 *weeks.*

BELTED D. C. GENERATORS

2673—One 100-kw., 530-r.p.m., 115-volt, d rect current compound wound C & C Generator, complete with pulley, field rheostat and base. *Immediate.*

2674—One 100-kw., 750-r.p.m., 125-volt, direct current compound wound General Electric, type MP Generator complete with pulley, field rheostat and base. *Immediate.*

2295—One 75-kw., 125-volt, 975-r.p.m., 6-pole, direct current Ft. Wayne-General Electric, type LB, complete. *Immediate.*

DIRECT CONNECTED A. C. UNITS

S2613—One 160-kva., 200-r.p.m., 220/440-volt, 3-phase, 60-cycle Crocker-Wheeler Revolving Field Alternator, direct connected to 14¼ x 23 x16 Ames Tandem compound engine, running at 200-r.p.m. (forms right-hand set, and is complete with belted exciter and field regulator). 2 *weeks.*

S2631E—One 105-Kva., 256-r.p.m., 2300-volt, 3-phase, 60-cycle General Electric, revolving field, type ATB alternator, complete with field rh ostat. and direct connected exciter; and direct connected to a 15 x 14 Harrisburg Simple Engine with oiling system. Left-hand set.

DIRECT CONNECTED D. C. UNITS

Two—150-kw., 250-volt G. E. direct connected to Erie Ball Corliss Valve 200-r.p.m. Engine Sets.

S1874—One 75-kw., 250-volt, direct current, compound wound General Electric Generator, direct connected with 15 x14 Harrisburg center crank engine: left-hand set. *Immediate shipment.*

S2182—One 50-kw., 250-volt, 280-r.p.m. Crocker-Wheeler, compound wound Generator, direct connected to Buffalo Forge. 12 x 12 simple engine. *Immediate shipment.*

S2530—One 50-kw., 125/250-volt, Westinghouse engine type generator mounted on extended engine base and direct connected to following engine.
One Ball Tandem Compound Engine 11 & 16 x 12 at 280 r.p.m., forming left hand unit complete with all usua accessories and oiling system

Complete line of 25-Cycle MOTORS, from 5 to 350-Hp.

OFFICES AND SHOPS

SEVENTH AND ADAMS STS., HOBOKEN, N. J.

Telephones: Hoboken 720-721

BILL WRIGHT *says:—*

"Speaking of Xmas—if my stockings were as badly filled as some of the bow-legged lassies I see about town I'd feel plumb embarrassed!"

Nothing But Good Equipment

New and Used — Guaranteed Condition — Ready to Ship

ALTERNATING CURRENT MOTORS

Slip Ring—3-Phase, 60-Cycle

No.	Hp.	Volt	Speed	Make	Type
1	300	2200	600	General Electric	M
1	230	2230	600	General Electric	M
1	200	220/440	600	General Electric	M
1	150	220/440	600	General Electric	M
1	100	440/220	720	General Electric	M
2	100	2200	720	General Electric	M
1	75	220/440	720	Westinghouse	CW
1	75	220/440	720	General Electric	M
2	75	440/220	900	General Electric	MT
1	60	220/440	1200	General Electric	MT
2	60	440/220	900	General Electric	MT
1	50	550	900	General Electric	MT
1	50	440/220	1200	General Electric	MT
1	50	220/440	720	General Electric	MT
1	50	440/220	900	Allis-Chalmers	ANY
3	50	220/440	900	General Electric	MT
1	50	2200	900	General Electric	M
1	50	440/220	900	Allis-Chalmers	ANY
1	40	2220	900	General Electric	MT
1	40	440/220	1200	General Electric	MT
2	35	440/220	900	Allis-Chalmers	ANY
1	30	440/220	1200	Allis-Chalmers	ANY
1	30	440/220	900	Allis-Chalmers	ANY
4	15	440/220	1200	General Electric	M

Squirrel Cage—3-Phase, 60-Cycle

1	200	440	600	General Electric	K
1	100	440/220	900	General Electric	K
2	100	440/220	720	General Electric	K
1	100	440/220	1800	Westinghouse	CS
1	100	440/220	1200	General Electric	KT
1	75	440/220	720	General Electric	K
2	50	440/220	1200	General Electric	KT
2	50	440/220	900	General Electric	KT
1	50	220/440	900	General Electric, wound rot	L
1	50	220/440	900	Allis-Chalmers	AN
2	40	220/440	1200	General Electric	KT
3	25	440/220	600	Allis-Chalmers	AN
2	25	220/440	1200	General Electric	KT
2	15	440/220	1200	General Electric, wound rotor	L
1	10	440/220	1200	General Electric, wound rotor	L
1	10	220/440	1200	Allis Chalmers	AN
1	7½	440/220	1200	General Electric, wound rotor	L

Single-Phase, 60-Cycle

11	5	110/220	1800	General Electric	RI
3	5	110/220	1200	General Electric	RI
3	3	110/220	1800	General Electric	RI
1	3	110/220	1200	General Electric	RI
13	2	110/220	1800	General Electric	RI

3-Phase, 25-Cycle

1	100	440	500	General Electric, squirrel cage	K

2-Phase, 60-Cycle

1	50	220/440	900	General Electric, slip ring	MQ
1	50	220/440	1200	General Electric, slip ring	MQ
1	40	220/440	1200	General Electric, slip ring	MQ
1	35	220/440	900	Allis-Chalmers, slip ring	ANY
1	25	220/440	720	General Electric, squirrel cage	IQ
2	15	220/440	1200	General Electric, slip ring	M
2	15	220/440	1200	General Electric, wound rotor	L
2	10	220/440	1200	General Electric, wound rotor	L
2	10	220/440	720	General Electric, squirrel cage	IQ

DIRECT CURRENT MOTORS

1	100	230	600	General Electric, interpole	RC
2	100	230	950	General Electric, interpole	RC
3	100	230	1150	General Electric, interpole	RC
1	90	230	500	General Electric	CL-A
1	75	230	1150	General Electric, interpole	RC
1	75	230	950	General Electric, interpole	RC
1	75	230	1100	Westinghouse	S
1	50	230	1000	Westinghouse	SK
1	30	230	700	Sprague General Electric	D
1	20	115	1150	General Electric, interpole	RC
8	10	230	1150	General Electric, interpole	RC
1	5	115	1150	General Electric, interpole	RC
1	5	230	1150	General Electric, interpole	RC

DIRECT CURRENT GENERATORS

1—33 Kw. 125 V., 725 R.P.M. compound wound Sprague Generator, complete with base, pulley and rheostat.

1—30 Kw. 125 V., 700 R.P.M. compound wound General Electric C.L. form Generator, complete with base, pulley and rheostat.

1—17 Kw. 250 V., 1125 R.P.M. compound wound Westinghouse, type S Generator complete with base, pulley and rheostat.

1—11¾-kw., 125-volt, 1125 r.p.m. compound wound Westinghouse type M generator, complete with base, pulley and rheostat.

MOTOR GENERATOR SETS

1—45-kw., 250-volt, 1150 r.p.m. compound wound Westinghouse type SK D. C. generator coupled by means of flexible couplings to 75 h.p. 440/220-volt, 3-phase, 60-cycle, G. E. squirrel cage motor, complete with rheostat and starting compensator.

1—17 Kw. 250 V., 1150 R.P.M. compound wound Westinghouse type S., D.C. Generator, coupled by means of flexible coupling to 25 Hp., 220/440 V., 3 Ph. 60 Cy. General Electric squirrel cage motor, complete with rheostat and starting compensator.

1—11¾-kw., 125-volt, 1150 r.p.m. compound wound Westinghouse type M D. C. generator coupled by means of flexible coupling to 20 h.p., 220/440-volt 3-phase, 60-cycle General Electric squirrel cage motor, complete with rheostat and starting compensator.

2—9-kw., 125-volt, 1750 r.p.m., compound wound Westinghouse, type SK, D.C. Generator, mounted on base with and coupled to 14-hp., 220/440-volt, 3-phase, 60-cycle Westinghouse, C.S., squirrel cage motor, complete with rheostat and starting compensator.

Alternating Current Generators

1—75-kw. G. E. 240/480-volt, 1200-r.p.m., 3-phase, 60-cycle, revolving field generator, complete with direct connected exciter, base, pulley and rheostat.

1—30 Kva. Westinghouse, 480/240 V., 1200 R.P.M., 3 Ph., 60 Cy. revolving field Generator, complete with belted exciter, base, pulleys and rheostats.

STEPHEN HALL & CO., *Inc.*

90 WEST STREET, NEW YORK — TELEPHONES: RECTOR 3891, 3892, 3893

STOCK SHIPMENT

ALTERNATING CURRENT MOTORS

3-ph. 60-cy.—40° Rating

No.	HP.	RPM.	Volts	Type	Make
5	3	1800	220/440	A	Ideal
6	3	1800	220/440		Gen. Elec.
6	5	1800	220/440	A	Ideal
4	5	1200	220/440	M	Cleveland
10	5	1200	220/440	A	Idea l
4	7½	1800	220/440	A	Ideal
2	7½	1200	220/440	A	Ideal
2	10	1800	220/440	AN	Allis-Chal.
3	10	1200	220/440	M	Cleveland
6	10	1200	220/440	A	Ideal
2	15	1800	220/440	AN	Allis-Chal.
5	15	1200	220/440	AN	Allis-Chal.
3	15	900	220/440	A	Ideal
1	20	1800	220/440		F.-M.
1	20	1200	220/440	A	Ideal
5	20	1200	220/440	AN	Allis-Chal.
1	25	900	220/440	BP	Wagner
2	30	1800	220/440	Slip ring	Westghse.
4	30	1200	220/440	CCL	Westghse.
5	30	1200	220/440	AN	Allis-Chal.
1	30	1200	220/440		Gen. Elec.
1	35	1800	220/440	I form K	Gen. Elec.
1	40	1800	220/0	CS	Westghse.
1	40	1200	220/440	CS	Westghse.
1	40	900	220/440	AN	Allis-Chal.
6	50	1200	220/440	AN	Allis-Chal.
1	50	1200	220/440	BW	Wagner
1	50	900	220/440	AN	Allis-Chal.
1	50	900	220/440	CS	Westghse.
1	50	900	220/440		Howell
1	50	720	220/440	Slip ring	Allis-Chal.
3	75	900	220/440	AN	Allis-Chal.
1	75	720	220/440	AN	Allis-Chal.
3	100	900	220/440	AN	Allis-Chal.
3	100	720	220/440	AN	Allis-Chal.
1	150	900	220/440	CS	Westghse.
1	150	720	220/440	CS	Westghse.
1	200	720	220/440	AN	Allis-Chal.
1	200	580	220/440	CS	Westghse.
1	200	450	220/440	I	Gen. Elec.
1	220	600	220/440	Slip ring	Westghse.
2	250	514	220/440		Westghse.
1	350	720	2200		Gen. Elec.
1	400	514	220/440	Slip ring	Allis-Chal.
1	400	450	550	Slip ring	Westghse.
1	750	514	2200	Slip ring	Allis-Chal.

SINGLE PHASE MOTORS

110/220 Volts, 60 cycle

No.	HP.	RPM.	Make
10	½	1800	Century
21	1	1800	Century
10	1½	1800	Century
5	2	1200	Century
20	2	1800	Century
12	3	1800	Century
5	5	1800	Century

DIRECT CURRENT MOTORS

115 Volts

No.	HP.	RPM.	WDG.	Type	Make
1	¼	1850	sh	CQ	Gen Elec.
2	¼	3800	sh		Watson
1	½	650	sh	CM	Cr.-Wh.
1	1	1100	sh		Thompson
1	1½	2100	sh	MP	Browning
1	2	1700	sh	RC	West.Elec.
1	4	800	series		Otis
3	5	1100	cp	TR	FM.
1	7½	740/1675	cp	S	Westghse
1	7½	1100	sh	MP	Allis-Chal.
1	10	650	sh	CQ	Gen Elec.
1	10	800	cp		Otis
1	13	1070	cp	CCM	Cr.-Wh.
2	15	1020	cp	M	Westghse
1	20	925	cp	MP	Gen Elec.
1	22	1050	sh	E-15	Milwauke
1	25	950	cp	S	Westghse
1	30	900	cp	S	Westghse
1	30	1050	cp	Bullock	Allis-Chal.
1	40	890	cp	ML	Wood
2	50	240	cp		West Elec.
1	67	990	cp		Burke
2	100	238	cp		Burke
1	105	655	sh		Gen Elec.

DIRECT CURRENT MOTORS

230 Volts

No.	HP.	RPM.	WDG	Type	Make
1	2½	470	cp	CCM	Cr.-Wh.
3	4	535/1070	sh	CM	Cr.-Wh.
3	4	1070	sh	CM	Cr.-Wh.
1	5	1200	sh	MP	Holtser Cabot
1	5	1650	sh	CE	Gen Elec.
1	5	1850	sh	CM	Cr.-Wh.
3	7½	825	sh	CVC	Gen Elec.
1	7½	825	cp	B-7	Milwaukee
3	7½	1150	cp	SK	Westghse
1	7½	1150	sh	MP	Gen Elec.
1	10	635	sh	MP	Gen Elec.
1	10	1700	sh	RC	Gen Elec.
1	15	750	sh	CVC	Gen Elec.
1	15	1170	sh	MP	Gen Elec.
1	20	650	sh		Milwaukee
1	20	900	sh	MP	Hobart
1	20	1150	sh	RC	Gen Elec.
1	35	720	cp		Lincoln
1	40	720	cp	S	Westghse
1	45	800	sh		Imperial
1	45	600/1200	sh		Northern
2	50	560	cp	CL	Gen Elec.
1	50	400/1200	cp		Westghse
1	55	425/850	sh	DLC	Gen Elec.
1	60	800	cp	MP	Gen Elec.
1	75	680	cp	M	Westghse
1	80	800	sh		Gen Elec.
1	90	1000	cp	A-50	Milwaukee

DIRECT CURRENT MOTORS

500 Volts

No.	HP.	RPM	WDG	Type	Make
1	5	1625	sh	MP	Fr-Morse
1	7½	800	sh		Keystone
1	10	1350	sh		West Elec
1	15	1150	sh	MP.	Westghse
1	20	1275	sh		Fr-Morse
1	20	1125	sh	Class 4	Gen. Elec.
1	20	1125	sh		Gen. Elec.
1	35	585	sh	CL	Gen. Elec.
1	35	565	sh	CL	Gen Elec.
1	45	875	cp		Burke
1	265	510	cp		Westghse

DIRECT CURRENT GENERATORS

250 Volts

No.	KW	RPM.	WDG	Type	Make
1	11½	1350	sh	MP	Gen Elec
1	15	1325	sh	RC	Gen Elec.
1	25	850	cp		Lincoln
1	30	725	cp	S	Westghse
1	35	920	sh		Imperial
2	38	650	cp	CL	Gen Elec.
1	45	920	cp	MP	Gen Elec.
1	56	800	cp	M	Westghse
1	60	920	sh	DLC	Gen Elec.
1	65	860	cp	M	Westghse
1	70	1150	cp	A-50	Milwaukee
1	85	275	cp	CCD	Cr.-Wh.
1	100	850	cp.		Thom.-Ryan
1	150	550	cp		Morgan Gard.
1	200	500	cp		Northern
1	225	575	cp		Thom.-Ryan

MOTOR GENERATOR SETS

1—25 kw. 250 v. 860 rpm., cp. wd. Lincoln D.C. Generator, direct connected to 1—new Allis-Chalmers 220 or 440 v. 860 rpm., 3 ph. 60 cy. Induction motor, complete.

1—45 kw. 500 v. 900 rpm., cp. wd. General Electric D.C. generator direct connected to 1—220 or 440 v. 900 rpm., 3 hp. 60 cy. new Allis-Chalmers inducton motor, complete.

1—65 kw. 250 v. 860 rpm., cp. wd. Westinghouse D.C. generator, direct connected to 1—220 or 440 v. 860 rpm., 3 ph. 60 cy. new Allis-Chalmers induction motor, complete.

1—70 kw. 250 v. 860 rpm., cp. wd. General Electric generator, direct connected and mounted on common bed plate with 1—220 or 440 v. 3 ph. 60 cy. new Allis-Chalmers induction motor, complete.

1—100 kw. 250 v. 690 rpm., cp. wd. Thomson-Ryan D.C. generator direct connected to 1—Westinghouse 220 or 440 v. 690 rpm., 3 ph. 60 cy. induction motor, complete.

1—150 kw. 125/250 v. 1200 rpm., cp. wd. Westinghouse rotary converter with transformers for 2200 v. high tension, 3 ph. 60 cy. 187 v. low tension, starting taps, complete with starting equipment and switchboard.

1—150 kw. 125/250 v. D.C. 3 wire, Burke Electric motor generator set, consisting of 2—75 kw., 125 v., cp. wd. Burke Generators, belted or chain driven, by 1—new 2200 v. or 440 v. 3 ph. 60 cy. Allis-Chalmers motor, complete.

1—200 kw. 500/550 v. 580 rpm, cp. wd. Westinghouse D.C. generator direct connected and mounted on common base with 1—2200 v. 3 ph. 60 cy. Type CCL Westinghouse induction motor complete with starter and D.C. panel.

1—200 kw. 250/275 v. 900 rpm., cp. wd. Ridgway D.C. generator, direct connected and mounted on common base with 1—2200 v. 3 hp. 60 cy. Ridgway Synchronous motor complete.

DIRECT CURRENT ENGINE GENERATOR SETS

250 Volts

—30 kw. 250 v. 800 rpm., cp. wd. Type S Westinghouse D.C. generator belted to 1—Ball Single cylinder horizontal steam engine, 100 lbs. steam pressure, 200 rpm., complete with belt pulleys, field rheostat and switchboard panel.

1—35 kw. 250 v. 900 rpm., Imperial D.C. generator belted to 1—Atlas horizontal single cylinder center crank 4 valve steam engine, 11¼ x 14, 100 lbs. steam pressure, complete with belts, pulleys, field rheostat and switchboard panel.

1—65 kw. 860 rpm., cp. wd. Type M Westinghouse D.C. generator, belted to 1—Ball horizontal single cylinder slide valve steam engine, 12 x 12, 100 lbs. steam pressure, 250 rpm., complete with belt, pulleys, field rheostat, generator switchboard and all accessories.

1—75 kw. 250 v. 285 rpm., cp. wd. Westinghouse D.C. generator, belted to 1—Lord Howler horizontal single cylinder slide valve steam engine, 125 hp. 220 rpm., 100 to 125 lbs. steam pressure, complete with al accessories, including switchboard.

1—100 kw. 250 v. 250 rpm. 6 pole, General Electric D.C. generator, direct connected and mounted on common bed plate with 1—Erie City Iron Works, horizontal single cylinder side crank slide valve left hand steam engine, 185 hp. 250 rpm. 100 lbs. steam pressure, 17 x 16 complete with all accessories.

1—125 kw. 250 v. 250 rpm. cp. wd. Ridgway D.C. generator, direct connected and mounted on bed plate with 1—Ridgway horizontal single cylinder slide valve, side crank steam engine, 225 hp., 250 rpm., 16 in. bore, 18 in. stroke, complete with all accessories.

2—250 kw. 250/275 v. 175 rpm. Ridgway D.C. generator, direct connected and mounted on common bed plate with 1—Ridgway horizontal single cylinder single slide valve right hand steam engine, 22 x 24, 100 to 125 lbs. steam pressure, complete with all accessories.

MINING MACHINES

2—27-A Jeffrey 250 v. D. C. low vein coal cutters 36 in gauge 5 ft. cutter bar.

2—CE-7 Sullivan 220 v. 3 ph. 60 cy. 36 in gauge, 7½ ft. cutter bar A. C. shortwall mining machines.

1—Morgan Gardner Type SA shortwall mining machine, 250 v.D. C. 42 in.gauge, 6 ft. cutter bar.

MINING LOCOMOTIVES

1—4½ ton, 250 v. D.C. 36 in. gauge, brand new Baldwin Westinghouse bar steel type trolley haulage locomotive, complete. Immediate shipment.

1—6 ton, Baldwin Westinghouse bar steel type trolley haulage locomotive, 250 v. D.C. 36 in. gauge, Excellent condition.

1—10 ton, Goodman Type 8M, 10-A trolley type haulage locomotive. 250 v. D.C. 36 in gauge.

1—13 ton Morgan Gardner trolley type haulage locomotive, 250 v. D.C. 44 in. gauge

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DUQUESNE
New and used Electrical Equipment
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New Motors in Stock *Immediate Delivery*

550-VOLT, D.C. MOTORS

2—2-hp., 550-volt, 1725-r.p.m., Type "CD" Westinghouse, 40° rise.
3—2-hp., 550-volt, 1490-r.p.m., Type "GL", Frame "L" C-W's.
1—3-hp., 550-volt, 1900-r.p.m., Type "CD", Westinghouse, 40° rise.
16—3-hp., 550-volt, 1340-r.p.m. Crocker-Wheeler Motors, 40° rise.
8—3-hp., 550-volt, 1200-r.p.m., Type "SK" Westinghouse, 40° rise.
2—3¼-hp., 550-volt, 900-r.p.m., Type "DC", comp. wound, totally enclosed Westinghouse Motors, 40° rise.
2—5-hp., 550-volt, 1800-r.p.m., Type "MC" General Electric Motors.
1—5-hp., 550-volt, 1300-r.p.m., Type "RC" second-hand General Electric Motor, 50° rise.
9—5-hp., 550-volt, 1160-r.p.m. Crocker-Wheeler Motors, 40° rise.
4—5 hp., 550-volt, 720-r.p.m., Type "SK", totally enclosed Westinghouse Motors, special Frick Motors, 40° rise.
5—7½-hp., 550-volt, 1300-r.p.m., Type "RC" C. F., 50° rise.
1—7½-hp., 550-volt, 950-r.p.m., Type "7½-1" comp.wd.,C-W.,40°rise.
3—10-hp., 550-volt, 1800-r.p.m., Type "RC" General Electric, 50° rise.
5—10-hp., 550-volt, 1700-r.p.m., Type "SK" Westinghouse, 40° rise.
7—10-hp., 550-volt, 1150-r.p.m., Type "SK" Westinghouse Motors.
1—15-hp., 550-volt, 1250-r.p.m., Type "RC" General Electric, 50° rise.
1—15-hp., 550-volt, 1800-r.p.m., Type "RC", comp. wound General Electric Motor, 50° rise.
1—30-hp., 550-volt, 900-r.p.m., Type "RC", shunt wound General Electric Motor, 40° rise.
1—40-hp., 550-volt, 875-r.p.m., Type "RC", comp. wound General Electric Motor, 50° rise.
3—50-hp., 550-volt, 1700-r.p.m., Type "SK", comp. wound Westinghouse Motors, 40° rise.
1—75-hp., 550-volt, 1700-r.p.m., Type "SK," comp. wound Westg.

230-VOLT, D.C. MOTORS

6—1-hp., 230-volt, 1200-r.p.m., Type "CD" Westinghouse Motors.
2—2-hp., 230-volt, 1180-r.p.m., Type "CD" Westinghouse, 40° rise.
5—3-hp., 230-volt, 1800-r.p.m., comp. wd. Crocker-Wheeler, 40° rise.
2—3-hp., 230-volt, 1700-r.p.m., Type "MC", comp. wound, mine type General Electric Motors, 40° rise.
5—3-hp., 230-volt, 1725-r.p.m., Type "CD", form comp. Westinghouse Motors, 40° rise.
1—3-hp., 230-volt, 1150-r.p.m., Type "MC" General Electric Motor.
27—3-hp., 230-volt, 1150-r.p.m., Type "SK" Westinghouse, 40° rise.
5—5-hp., 230-volt, 960-r.p.m. Crocker-Wheeler Motors.
3—7½-hp., 230-volt, 1800-r.p.m., Type "SK" Westinghouse, 40° rise.
1—7½-hp., 230-volt, 1700-r.p.m., type "RC", comp. wound General Electric Motor, 40° rise.
4—7½-hp., 230-volt, 1425-r.p.m. Crocker-Wheeler Motors, 40° rise.
2—7½-hp., 230-volt, 500-1500-r.p.m., Type "SK" Westinghouse Motors, 40° rise. Second-hand.
19—7½-hp., 230-volt, 1150-r.p.m., Type "SK" Westinghouse Motors.
2—7½-hp., 230-volt, 875-r.p.m., comp. wound C-W, 40° rise.
1—10-hp., 230-volt, 1700-r.p.m., Type "RC", comp. wound General Electric Motor, 40° rise.
1—10-hp., 230-volt, 1150-r.p.m., Type "RC", comp. wound General Electric Motor, 50° rise.
6—10-hp., 230-volt, 1150-r.p.m., Type "SK" Westinghouse, 40° rise.
1—15-hp., 230-volt, 1700-r.p.m., Type "SK" Westinghouse, 40° rise.
2—15-hp., 230-volt, 1700-r.p.m., Type "RC", comp. wound General Electric Motors, 50° rise.
2—15-hp., 230-volt, 400-1600-r.p.m., sh. wound Reliance, 40° rise.
1—15-hp., 230-volt, 1150-r.p.m., Type "RC" General Electric Motor, comp. wound, 50° rise.
2—15-hp., 230-volt, 1250-r.p.m., Type "SK" Westinghouse, 40° rise.
1—15-hp., 230-volt, 850-r.p.m., Type "RC" General Electric, 50° rise.
2—15-hp., 230-volt, 850-r.p.m., Type "SK" Westinghouse, 40° rise.
1—20-hp., 230-volt, 1700-r.p.m., Type "SK" Westinghouse, 40° rise.
1—20-hp., 230-volt, 1700-r.p.m., Type "RC", Form Comp. General Electric Motor, 50° rise.
1—25-hp., 230-volt, 775-r.p.m., Type "RC", comp. wound General Electric Motor, 40° rise.
5—30-hp., 230-volt, 1700-r.p.m., Type "SK" Westinghouse, 40° rise.
1—30-hp., 230-volt, 1500-r.p.m., shunt wound Reliance, 40° rise.
1—35-hp., 230-volt, 1600-r.p.m. Reliance Motor, 40° rise.
1—40-hp., 230-volt, 1700-r.p.m., Type "SK" Westinghouse Motor.
1—50-hp., 230-volt, 1700-r.p.m., Type "SK" Westinghouse, 40° rise.

110-220-VOLT, A.C. MOTORS

2—¼-hp., 110/220-volt, 1725-r.p.m., Type "BA" Wagner, 40° rise.
1—½-hp., 110/220-volt, 1750-r.p.m., single phase, 60-cycle Century Motor, 40° rise.
3—½-hp., 110/220-volt, 1140-r.p.m., Type "BA" Wagner, 40° rise.
3—¾-hp., 110/220-volt, 1750-r.p.m., Type "RS" Century, 40° rise.
3—¾-hp., 110/220-volt, 1725-r.p.m., Type "BA" Wagner Motors.
1—¾-hp., 110/220-volt, 1165-r.p.m., single phase Century, 40° rise.
3—¾-hp., 110/220-volt, 1140-r.p.m., Type "BA" Wagner, 40° rise.
7—1-hp., 110/220-volt, 1750-r.p.m., single phase, 60-cycle Century Motors, 40° rise.
1—1-hp., 110/220-volt, 1725-r.p.m., Type "BA" Wagner, 40° rise.
2—1-hp., 110/220-volt, 1165-r.p.m., 60-cycle Century Motors, 40° rise.
8—1-hp., 110/220-volt, 1150-r.p.m., Type "BA" Wagner, 40° rise.
3—1½-hp., 110/220-volt, 1165-r.p.m., single phase Century Motors.
7—1½-hp., 110/220-volt, 1150-r.p.m., Type "BA" Wagner Motors.
11—2-hp., 110/220-volt, 1750-r.p.m., single phase, 60-cycle, Century Motors, 40° rise.
9—2-hp., 110/220-volt, 1750-r.p.m., Type "BA", single phase, 60-cycle Wagner Motors, 40° rise.
11—2-hp., 110/220-volt, 1150-r.p.m., single phase, 60-cycle Century Motors, 40° rise.
11—2-hp., 110/220-volt, 1165-r.p.m., single ph., 60-cy, Wagner, 40° rise.
7—3-hp., 110/220-volt, 1750-r.p.m., Type "BA", single phase, 60-cycle Wagner Motors, 40° rise.
14—3-hp., 110/220-volt, 1750-r.p.m., single phase, 60-cycle Century.
6—3-hp., 110/220-volt, 1150-r.p.m., single phase, 60-cycle Century Motors, 40° rise.
2—3-hp., 110/220-volt, 1160-r.p.m., Type "BA" Wagner, 40° rise.
2—5-hp., 110/220-volt, 1750-r.p.m., Type "SP", 60-cycle Century Motors, 40° rise.
2—½-hp., 104/208-volt, 1750-r.p.m., Century, vertical, 40° rise.
1—1-hp., 104/208-volt, 1750-r.p.m. Century Motor, vertical, 40° rise. Second-hand.
1—1-hp., 110-volt, 1200-r.p.m., Type "KQ 122", 2-phase General Electric Motor, 40° rise.
1—15-hp., 110-volt, 1050-r.p.m., comp. wound Watson Motor, 40° rise. Second-hand.
2—3-hp., 115-volt, 1750-r.p.m. Robbins & Myers, D.C., shunt wound Motors, 40° rise.

220-VOLT, A.C. MOTORS

1—1-hp., 220-volt, 3600-r.p.m., Type "KT" General Electric, 40° rise.
7—1-hp., 220-volt, 1800-r.p.m., Type "KQ", 2-ph. G. E., 50° rise.
16—1-hp., 220-volt, 1800-r.p.m., Type "KT" General Electric, 50° rise.
1—1-hp., 220-volt, 1750-r.p.m. Robbins & Myers Motor, second-hand.
1—1-hp., 220-volt, 1200-r.p.m., Type "KQ", 2-phase G. E., 40° rise.
1—1-hp., 220-volt, 1200-r.p.m. Crocker-Wheeler Motor.
5—1½-hp., 220-volt, 1200-r.p.m., Type "KT", 3-phase, 60-cycle General Electric Motors, 50° rise.
1—2-hp., 220-volt, 1725-r.p.m., Type "CSA ', 2-phase Westinghouse.
2—2-hp., 220-volt, 1200-r.p.m., Type "KT" General Electric, 50° rise.
1—3-hp., 220-volt, 1800-r.p.m., Type "KT" General Electric, 50° rise.
1—3-hp., 220-volt, 1720-r.p.m. Swaby Vertical Motor, 40° rise.
6—3-hp., 220-volt, 1130-r.p.m., 3-phase, 60-cycle C.W., 40° rise.
1—5-hp., 220-volt, 1800-r.p.m., Type "CS" Westinghouse Motor.
7—5-hp., 220-volt, 1800-r.p.m., Type "KT" General Electric, 50° rise.
2—5-hp., 220-volt, 1720-r.p.m. Crocker-Wheeler Motors, 40° rise.
1—5-hp.,220-volt, 1720-r.p.m., Type "BP", 3-phase, 60-cycle Wagner Motor, 40° rise.
1—7½-hp., 220-volt, 1800-r.p.m., Type "KT" G. E., 40° rise.
1—7½-hp., 220-v., 1740-r.p.m., Type "CS.", 3-ph. Westg., 50° rise.
1—7½-hp., 220-volt, 1500-r.p.m., Type "KT" 302, 25-cycle General Electric Motor, 40° rise.
5—7½-hp., 220-v., 1200-r.p.m., Type "KT" General Electric, 50° rise.
1—7½-hp., 220-volt, 1140-r.p.m., Type "BN" Wagner, 40° rise.
12—10-hp., 220-volt, 1800-r.p.m., Type "CS" Westinghouse, 40° rise.
1—10-hp., 220-volt., 1150-r.p.m. Century, second-hand, 40° rise.
1—10-hp., 220-volt, 1900-r.p.m., Type "CS" Westinghouse Motor.
2—15-hp., 220-volt, 1200-r.p.m., Type "KT" General Electric Motors.
1—15-hp., 220-volt, 1140-r.p.m., Type "BW" Wagner Motor, 40° rise.
1—20-hp., 220-volt, 1800-r.p.m., Type "CS", 60-cycle Westinghouse.
1—20-hp., 220-v., 1200-r.p.m., Type "CS," 60-cyc. Westg., 40° rise.
1—20-hp., 220-volt, 860-r.p.m. Westinghouse Motor, 40° rise.
4—25-hp., 220-v., 1800-r.p.m., Type "CS," 60-cyc., Westg., 40° rise.
3—25-hp., 220-volt, 1200-r.p.m., Type "KT", Form "K", 60-cycle General Electric Motors, 50° rise.
1—30-hp., 220-volt, 865-r.p.m. Allis-Chalmers, second hand, 40° rise.
2—40-hp., 220-volt, 1800-r.p.m., Type "KT", Form "K", 60-cycle General Electric Motors.
7—50-hp., 220-volt, 1800-r.p.m., Type "KT", Form "K", 60-cycle General Electric Motors, 40° rise.
1—60-hp., 220-volt, 1800-r.p.m., Type "K" General Electric, 50° rise.
2—75-hp., 220-volt, 1800-r.p.m., Type "KT", Form "K", 60-cycle General Electric Motors, 40° rise.

440-VOLT, A.C. MOTORS

1—¾-hp., 440-volt, 1140-r.p.m., Type "CSA" Westinghouse Motor.
1—1-hp., 440-volt, 1800-r.p.m., Type "KT," 60-cycle G.E.
2—1-hp., 440-v., 1800 r.p.m., Type "KT." Form "K," 60-cycle, G. E.
1—1½-hp., 440-volt, 1800-r.p.m., Type "KT" General Electric Motor.
2—2-hp., 440-volt, 1200-r.p.m., Type "KT", Form "K", 60-cycle General Electric Motors, 50° rise.
1—3-hp., 440-volt, 1800-r.p.m., Type "KT", Form "K", 60-cycle General Electric Motors, 50° rise.
2—3-hp., 440-volt, 1200-r.p.m. Crocker-Wheeler Motors.
20—5-hp., 440-volt, 1800-r.p.m., Type "KT", Form "K", 60-cycle General Electric Motors, 50° rise.
1—5-hp., 440-volt, 1800-r.p.m., Type "CS" Westinghouse Electric.
3—5-hp., 440-volt, 1800-r.p.m., Crocker-Wheeler Motors, 40° rise.
2—5-hp., 440-volt, 900-r.p.m., Type "KT," 3-phase, 60-cycle G.E.
2—5-hp., 440-volt, 1150-r.p.m. Crocker-Wheeler Motors.
5—7½-hp., 440-v., 1800-r.p.m., Type "KT," Form "K" G.E., 40° rise.
3—10-hp., 440-volt, 1800-r.p.m., Type "CS" Westinghouse, 40° rise.
1—10-hp., 440-v., 1165-r.p.m., Type "AS" Century, 40° rise. Sec. hd.
2—15-hp., 440-volt, 1200-r.p.m., Type "KT," Form "K" G. E.
1—20-hp., 440-volt, 1200-r.p.m., Type "KT," form "K" G.E.
2—25-hp., 440-volt, 1800-r.p.m., Type "CS" Westinghouse, 50° rise.
2—40-hp., 440-volt, 1200-r.p.m., Type "KT," Form "K" G. E.
1—50-hp., 440-v., 1800-r.p.m., Type "KT," Form "K" G. E., 40° rise.
3—50-hp., 440-volt, 1800-r.p.m., Type "CS" Westinghouse, 40° rise.
1—50-hp., 440-v., 1200-r.p.m., Type "KT," Form "K" G. E., 40° rise.
1—50-hp., 440-volt, 900-r.p.m., Type "KT" G. E., 40° rise.
1—60-hp., 440-volt, 1800-r.p.m., Type "KT" G. E., 50° rise.
2—75-hp., 440-v., 1800-r.p.m., Type "KT," Form "K" G. E., 40° rise.
1—75-hp., 440-volt, 1800-r.p.m., Type "CS" General Electric, 40° rise.
2—100-hp., 440-volt, 1800-r.p.m., Type "KT" G. E., 40° rise.
1—100-hp., 440-volt, 860-r.p.m., Type "CS" Westgh., 40° rise.

HARRIS PUMP & SUPPLY COMPANY

"THE BIG MOTOR HOUSE"

316-322 SECOND AVE. { PITTSBURGH, PA. } 319-321 FIRST AVE.

THE MOTOR YOU NEED

IN STOCK-FOR IMMEDIATE DELIVERY

Quantity	Hp.	Volts	Speed	Phase	Cycles	Make and Type		Deg
3	2	220	1800	3	60	General Electric	KT	50
2	3	220	1200	3	60	General Electric	KT	50
1	7½	220	1800	3	60	General Electric	KT	50
2	10	220	1800	3	60	General Electric	KT	50
5	15	220	1200	3	60	General Electric	KT	50
1	15	220	1800	3	60	General Electric	KT	50
2	20	220	1200	3	60	General Electric	KT	50
3	25	220	1200	3	60	General Electric	KT	50
3	30	220	1200	3	60	General Electric	KT	50
3	30	220	1800	3	60	General Electric	KT	50
2	40	220	1200	3	60	General Electric	KT	50
2	50	220	1200	3	60	General Electric	KT	50
2	2	440	1200	3	60	General Electric	KT	50
2	7½	440	1800	3	60	General Electric	KT	50
3	20	440	900	3	60	General Electric	KT	50
1	25	440	900	3	60	General Electric	KT	50
1	25	440	1200	3	60	General Electric	KT	50
2	30	440	1200	3	60	General Electric	KT	50
1	40	440	1200	3	60	General Electric	KT	50
1	50	440	1200	3	60	General Electric	KT	50
1	10	440	750	3	25	General Electric	KT	50
3	15	440	1500	3	25	General Electric	KT	40
1	30	440	750	3	25	General Electric	KT	40
15	40	440	750	3	25	General Electric	KT	40
1	1/6	110	1700	Direct Current		General Electric	SD	..
1	1	230	1150	Direct Current		General Electric	RC	..
20	¼	110/220	1700	1	60	Westinghouse Elec.	ARS	..
22	¼	110/220	1725	1	60	Westinghouse Elec.	ARS	..
23	1/12	110/220	1200	1	60	General Electric	SA	..
1	½	110/220	1800	1	60	General Electric	RI	..
2	1	110/220	1200	1	60	General Electric	RI	40
2	1	110/220	1800	1	60	General Electric	RI	40

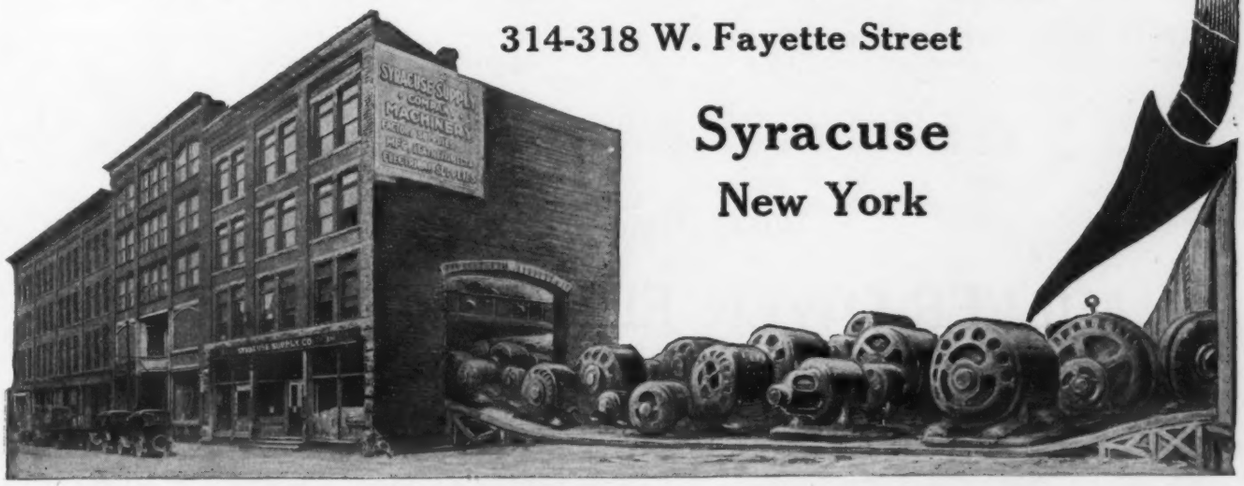
USED

3	40	440	750	3	25	General Electric	KT	40

SYRACUSE SUPPLY COMPANY

314-318 W. Fayette Street

Syracuse
New York



IMMEDIATE SHIPMENT

General Electric, 40 Deg. 3 Phase, 60 Cycle, 220 Volt

MOTORS

Shipped to Remington Arms Co., Bridgeport, Conn., during 1915 and used by them about two years. Motors in exceptionally fine physical condition. Each motor equipped with base and compensator.

Quantity	*H P.*	*Type*	*Speed*	*Price Each*
3	8	KT 101 Form C	1200 (Vertical)	$275
10	10	KT 312 Form B	900	300
47	15	KT 322 Form B	900	375
23	15	I Form K	900	375
91	20	KT 326 Form B	900	400
30	20	I Form K	900	400
32	25	KT 332 Form B	900	465
23	25	I Form K	900	465
34	35	KT 336 Form B	900	570
5	35	I Form K	900	570
2	50	I Form K	900	750
1	15	CS Westinghouse	860	375
2	50	CS Westinghouse	870	750
1	7½	BP Wagner	1100	225
1	20	BP Wagner	850	400
3	25	BP Wagner	850	465
1	35	BP Wagner	1720	375

QUANTITY DISCOUNTS—Orders exceeding $1000.00, and not over $2000.00, 10 per cent Discount. Exceeding $2000.00, and not over $3000.00, 10 and 5 per cent Discount. Exceeding $3000.00, 10 and 10 per cent Discount.

GUARANTEED as represented. Will be sold in present condition subject to return privilege if not as represented. If returned within thirty days from date of shipment with transportation to Pittsburgh, Penna., prepaid, we will at our option allow full credit or refund, or repair free of cost.

TERMS—Shipment F. O. B. cars Pittsburgh, Penna., or Bridgeport, Connecticut. Twenty-five per cent cash with order, balance sight draft Bill of Lading.

Wire, Phone or Write

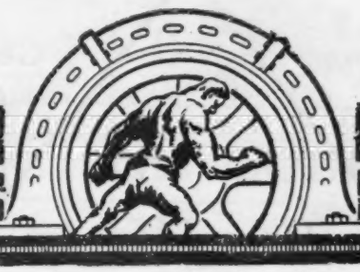
MILLER-OWEN ELECTRIC CO., Inc.

Pittsburgh, Penna.

"Honestly Rebuilt Electrical Machinery"

114 Liberty Street — New York, N. Y.

MAC GOVERN & COMPANY INCORPORATED



POWER MACHINERY

Motors in Stock

All Motors are 40° unless otherwise stated

3 PHASE, 60 CYCLE, 220/440 VOLT

Qu.	Hp.	Rpm.		Make	Type
2	¼	850		Richmond	.....
1	¾	690		Richmond	.....
1	5	1200	NEW	G. E.	KT 50°
3	5	800		W. E. (G. E.)	KT
9	7½	900		W. E. (G. E.)	KT
1	7½	900		Al.-Chal.	AN
1	7½	900	NEW	W. E. (G. E.)	KT
2	7½	1150		Westghse.	CS
1	7½	1200	NEW	G. E.	KT
2	7½	1200		G. E.	KT
1	7½	1200		Al.-Chal.	AN
1	7½	1200	NEW	Al.-Chal.	AN
3	7½	1200		Al.-Chal., sl. rg.	ANY
1	7½	1800		G. E.	KT
1	10	900	NEW	G. E.	KT 50°
1	10	1150		Al.-Chal.	AN
1	10	1200		W. E. (G. E.)	KT
1	10	1800		G. E. Vertical	KT
1	15	900		Al.-Chal.	AN
1	15	1200	NEW	G. E.	KT
1	15	1200	NEW	G. E.	KT 50°
1	20	900		W. E. (G. E.)	KT
1	20	900	NEW	Al.-Chal., sl. rg.	ANY
1	20	1150		Al.-Chal.	AN
1	20	1200		Fb.-Morse	KBV
4	20	1200	NEW	Al.-Chal.	AN
1	25	850		Westghse.	CCL
1	25	900		W. E. (G. E.)	KT
3	25	900		Al.-Chal.	AN
3	25	900	NEW	Al.-Chal.	AN
1	25	1200		W. E. (G. E.)	KT
1	30	490	NEW	Al.-Chal., enclosed	AN
1	30	900	NEW	G. E., slip ring	MT
2	30	1150	NEW	Al.-Chal.	AN
1	30	1200		Fb.-Morse, sl. rg.	BV
2	40	1150	NEW	Al.-Chal.	AN
1	40	1200		W. E. (G. E.)	KT
1	40	1200	NEW	G. E., slip ring	M
1	50	370		Westghse., vertical	CCL
1	50	720		G. E., slip ring	M
1	50	870	NEW	Westghse.	CS
2	50	900		G. E.	K
1	50	900		Westghse.	CS
2	50	900	NEW	Al.-Chal.	AN
1	50	900		G. E., slip ring	M
1	50	1200		W. E. (G. E.)	KT
2	50	1200		Al.-Chal.	AN
3	50	1200	NEW	Al.-Chal.	AN
1	50	1200	NEW	Al.-Chal.	AN
1	75	490		Al.-Chal.	AN
2	75	514		Al.-Chal., vertical	AN
1	75	720	NEW	G. E.	K
1	100	700	NEW	Westghse.	CS
1	100	700		Westghse., sl. rg.	CW
1	100	1800		G. E.	K
1	125	600		Westghse., sl. rg.	F
1	150	580		Westghse.	CS
2	150	580		Westghse.	CCL
3	150	600		Al.-Chal.	AN
2	150	720		G. E.	K
1	200	695		Al.-Chal., sl. rg.	ANY
2	225	600		Westghse. (Hoist)	CI
2	250	600		F.-M., ball bearing, sl. rg.	
1	250	600		G. E., sl. rg., 3-bear.	M
1	300	440		G. E., sl. rg., 3-bear.	M
1	350	600	NEW	Westghse., sl. rg. 3-bearing	CW
1	400	514	NEW	Al.-Ch., sl. rg.	ANY
1	500	360		Westghse.	CX

SINGLE PHASE, 60 CYCLE

1	7½	1165	104-208	Wagner	.....
1	10	1800	110	G. E.	IS

3 PHASE, 60 CYCLE, 550 VOLTS

Qu.	Hp.	Rpm.	Volts	Make	Type
1	5	1130		Westghse.	CS
1	5	1200		G. E., slip ring	.....
1	5	1800		G. E.	KT
1	10	1030		G. E., elevator	.....
3	15	1150		Al.-Chal.	AN
1	15	1740		Westghse.	CS
2	20	860		Al.-Chal.	AN
1	35	1170		Westghse.	CS
2	40	900	NEW	G. E.	KT
1	40	900		Al.-Chal., sl. rg.	ANY
1	40	1200		Westghse.	CS
1	50	1800		G. E.	IK
1	75	690		Al.-Chal.	AN
3	75	870		Westghse.	CS
1	75	900		G. E.	K
1	100	720		G. E.	K
1	100	720		Westghse., sl. rg.	CW
2	125	495		Al.-Chal., sl. rg.	.....
1	150	600		G. E.	L
1	150	600		G. E.	K
1	200	580		Westghse.	.....
1	400	435		Westghse., sl. rg.	CW

3 PHASE, 60 CYCLE, 2200 VOLTS

2	40	900	NEW	G. E.	KT
1	75	900		G. E.	K
1	100	720		G. E.	K
2	125	495		Al.-Chal., sl. rg.	.....
1	150	600		G. E.	L
1	150	600		G. E.	K
1	150	900	NEW	G. E., slip ring	M
1	200	580		Westghse.	.....
1	200	600		G. E., slip ring	M
1	200	600	NEW	G. E., slip ring	M
1	250	720		Cr.-Wh., slip ring	.....
1	250	600		Westghse.	C
1	800	514	NEW	G. E., slip ring	M
1	1400	514		Westghse., sl. rg.	CW

2 PHASE, 60 CYCLE

Qu.	Hp.	Rpm.	Volts		Make	Type
1	4½	720	115		Lincoln	IF
1	7½	1200	220		G. E.	KQ
1	20	1200	220		Westg., sl. rg.	CW
1	30	850	440		Westghse.	C
1	75	360	220		Burke	.....
1	100	690	220		Westghse.	CCL
1	150	1800	2200	NEW	G. E.	K
1	180	416	2200		Burke, sl. rg.	.....
1	200	580	220		Westghse.	CS
1	300	495	2000		Westghse.	C

3 PHASE, 25 CYCLE, 220/440 VOLT

1	2	750		G. E.	.....
1	10	1440		Westghse.	CCL
1	10	1500		G. E.	MC
2	15	1500		G. E.	K
1	37	750		G. E., slip ring	ITC
1	75	750		Westghse., sl. rg.	CW
1	75	750		Westghse.	CS
1	75	710		G. E., slip ring	M
1	75	1500	NEW	G. E.	K
2	100	375		G. E., vertical	K
1	200	500	NEW	G. E., slip ring	M
1	225	500		G. E., slip ring	M 50°

3 PHASE, 40 CYCLE, 550 VOLT

Qu.	Hp.	Rpm.		Make	Type
1	100	800	NEW	G. E.	L
2	150	600	NEW	G. E.	L

3 PHASE, 25 CYCLE, 2200 VOLTS

1	450	375	NEW	G. E., slip ring	P
1	1500	500		Westghse., sl. rg.	HF
1	1560	500		G. E., sl. rg.	M

2 PHASE, 25 CYCLE, 2200 VOLTS

Qu.	Hp.	Rpm.	Make	Type
1	8	375	G. E.	IQ
1	35	750	Burke	.....

DIRECT CURRENT MOTORS

Qu.	Hp.	Rpm.	Volt	Make	Type
1	½	1000	250 Comp.	Westghse.	M
1	1½	810	220 Series	Cr.-Wh.	SM
1	5	900	240 Series	Bullock	.....
1	5	1100	230 Comp.	Westghse.	.....
1	5	1200	220 Shunt	North.Elec.	.....
1	7½	600	220 Series	Westghse.	L
1	7½	850	220 Shunt	NEW West.	R-S
1	7½	1525	220 Shunt	G. E.	CQ
1	10	590	250 Shunt	Peerless	.....
1	10	650	220 Shunt	G. E.	CE
1	10	750	220 Shunt	No. Elec.	.....
1	10	800	250 Shunt	C. & C.	I-T
1	10	1000	230 Shunt	W. E. mill type	
1	10	1250	230 Shunt	G. E.	CL
1	10	1375	220 Shunt	G. E.	CE
1	12	1170	220 Shunt	Amer. Eng.	
1	15	360	500 Shunt	Westghse.	.....
2	15	690	220 Shunt	G. E.	CE
4	15	800	230 Shunt	Cr.-Wh.	CM
1	15	825	220 Shunt	W.E.(G.E.)	
1	15	1100	230 Shunt	G. E.	CE
1	20	1050	500 Shunt	G. E.	MP
1	25	600	220 Series	Bullock	.....
2	25	775	240 Shunt	Cr.-Wh.	CM
2	25	900	240 Shunt	Cr.-Wh.	CM
1	25	1100	240 Comp.	G. E.	MP
2	30	600	240 Series	Bullock	.....
1	30	1120	110 Comp.	Westghse.	.....
1	35	900	125 Comp.	Cr.-Wh.	CCD
1	35	540-1080	250 Shunt	G. E.	CL
1	40	800	230 Shunt	Sprague	D
1	40	900	220 Comp.	Sprague	.....
1	40	975	220 Shunt	G. E.	CL
1	40	1200	220 Shunt	Westghse.	S
1	52	275	550 Series	West. Hoist	K
1	55	845	220 Comp.	G. E.	CL
1	60	320	220 Comp.	W. E.	L4E
1	75	1000	125 Comp.	G. E.	H
1	100	720	230 Comp.	G. E.	RC
1	105	630	220 Comp.	G. E.	CL
1	200	560	220 Comp.	Westghse.	HS

Motors are all complete with pulleys, base or rails, and starting equipment, except five horsepower and smaller in alternating current motors, which do not require starters.

All are guaranteed to be in good operative condition

The above are only a few items from our large stock of Steam and Electrical Equipment, consisting of TURBO UNITS, RECIPROCATING UNITS, ROTARY CONVERTERS, MOTOR-GENERATOR SETS, CONDENSERS, BOILERS, PUMPS, ETC. Complete list will be gladly mailed upon request.

BRANCH OFFICES:

PITTSBURGH, PA.
498 Union Arcade Building

SEATTLE, WASH.
402 L. C. Smith Building

MONTREAL, QUE.
285 Beaver Hall Hill

We have in Stock Motors of any Horse Power, Phase, Speed, or Voltage, in either A. C. or D. C., New or Rebuilt.

Generators: Any K.W. Capacity, Belt or Engine Driven, in either D. C. or A.C., any Phase, Speed or Voltage.

We Wish You A Merry Christmas and a Prosperous New Year

We are back to pre-war conditions. Motors, generators, pumps, air compressors, boilers, and engines, which you knew were not efficient, but installed to meet war-time emergencies, have no longer a place in your plant. The day of keen competition has arrived, and if your equipment is not such that it will enable you to keep down excessive over-head and meet your competitors' prices, you will lose.

Give this matter serious thought—NOW—before it is too late. Let us know what your conditions are and we shall be glad to offer suggestions to you—it's a part of our service.

The month of December has been for us the BEST month of the year 1920—the natural result of the excellent service rendered during previous months.

Our business is built on the basis of sound judgment on all advice given and honest dealings—always. We realize that the success of our business rests with our ability to serve you efficiently.

Give us the opportunity during the coming year.

Pumps, Boilers, Air Compressors, Engines, Corliss Slide-Valve or Automatic. Why not call our engineers at once? It costs you nothing.

We send our Motor and Generator repairmen anywhere to Rewind, Rebuild or Reconnect for Phase or Voltage. Wire us.

BROWN-HUNKELE CORPORATION

12-26-28 Mechanic Street, Newark, N. J.

MOTORS

GENERATORS

SPILGER ELECTRIC COMPANY, Inc.

109 BARCLAY STREET
NEW YORK CITY

Phones
Barclay 4250-1-2

TWO PHASE SLIP-RING MOTORS

No.	Hp.	Make	r.p.m.
1	200	G. E. Slip Ring (new)	450
2	200	W. E. Slip Ring (new)	600
2	175	Stanley synch. (used)	900
2	150	W. E. Slip Ring (new)	600
2	150	G. E. Slip Ring (new)	720
1	100	W. E. Slip Ring (new)	600
1	100	G. E. Slip Ring (new)	720
1	100	W. E. Slip Ring (new)	900
1	75	G. E. Slip Ring (new)	600
1	75	W. E. Slip Ring (new)	720
1	75	W. E. Slip Ring (new)	900
6	50	W. E. Slip Ring (new)	1200
6	50	W. E. Slip Ring (new)	900

THREE PHASE SLIP-RING MOTORS

No.	Hp.	Make	r.p.m.
2	200	W. E. Slip Ring (new)	600
1	150	G. E. Slip Ring (new)	720
2	150	W. E. Slip Ring (new)	600
1	175	Stanley synch. (used)	900
3	100	G. E. Slip Ring (new)	900
2	100	W. E. Slip Ring (new)	720
3	100	G. E. Slip Ring (new)	600
3	75	W. E. Slip Ring (new)	900
3	75	W. E. Slip Ring (new)	720
3	75	W. E. Slip Ring (new)	600
8	50	G. E. Slip Ring (new)	1200
7	50	W. E. Slip Ring (new)	900
14	50	G. E. Slip Ring (new)	720

SINGLE-PHASE MOTORS

No.	Hp.	Make	r.p.m.
1	1.5	West. Elec. (G.E.) new	1800
4	5	West. Elec. (G.E.) new	1800
4	5	West. Elec. (G.E.) new	1200
4	3	West. Elec. (G.E.) new	1800
5	3	West. Elec. (G.E.) new	1200
7	2	West. Elec. (G.E.) new	1800
1	1	West. Elec. (G.E.) new	1800

No.	Hp.	Make	r.p.m.
25	½	General Electric (new)	1800
10	¼	Westinghouse (new)	1750
1	⅛	Sprague (used)	1800
2	⅛	General Electric (used)	1200
1	⅛	Colonial (used)	1800
1	⅛	Marathon (used)	1750
1	⅛	Holtzer Cabot (used)	1150

220 VOLT DIRECT CURRENT MOTORS

No.	Hp.	Make	r.p.m.
1	30	Northern (used)	1000
1	20	Burke used	650
4	15	West. Elec. (G.E.) new	850
2	15	West. Elec. (G.E.) new	1150
1	15	West. Elec. (G.E.) new	1500
7	10	West. Elec. (G.E.) new	850
8	10	General Electric .(W.E.) new	1150
10	10	General Electric. (W.E.) new	1700
10	10	Triumph (new)	1150
1	7.5	Watson (used)	1760
4	7.5	General Electric (new)	1150
4	7.5	General Electric (new)	1700
2	7.5	Triumph (new)	1760
2	7.5	Triumph (new)	1150
1	7.5	Holtzer-Cabot (used)	900
1	5	Watson (used)	1650
1	5	General Electric (new)	1700
4	5	General Electric (new)	1150
4	5	Triumph (new)	1750

No.	Hp.	Make	r.p.m.
6	5	Triumph (new)	1170
1	5	General Electric	1800
1	5	C & C (used)	1250
1	5	Reliance (used)	500-2000
4	3	Triumph (new)	1750
4	3	Triumph (new)	1150
4	3	West. Elec. (G.E.) new	1150
4	3	West. Elec. (G.E.) new	1700
1	3	General Electric (W.E.) used	1100
2	2	West. Elec. (G.E.) new	1150
3	2	General Electric (W.E.) new	1700
1	2	General Electric (W.E.) series	900
3	2	Triumph (new)	1750
1	1.5	Browning (used)	1950
2	1	General Electric (new)	1150
2	1	General Electric (new)	1700
1	1	Fidelity (series)	550
6	½	General Electric (new)	1350
3	¼	Emerson (compound)	1200

110 VOLT DIRECT CURRENT MOTORS

No.	Hp.	Make	r.p.m.
1	75	Eddy	500
1	35	Triumph (used)	800
2	30	Westinghouse	900
1	25	Sturtevant	875
1	20	Milwaukee	650
2	20	General Electric	900
1	3	Diehl	1550

No.	Hp.	Make	r.p.m.
1	3	Crocker Wheeler	950
1	2	General Electric	1350
2	2	Stanley	1350
3	⅛	Holtzer Cabot	1800
1	1/6	Emerson	1800
1	⅛	Roth	1300

COMPLETE LINE OF ALL SIZES NEW AND USED MOTORS IN STOCK
FOR IMMEDIATE DELIVERY ***COMPLETE LIST MAILED ON REQUEST***

GEORGE SACHSENMAIER COMPANY, PHILADELPHIA, PA.

Office: 926 No. 3rd Street ***Warehouse and Shops: 928-30-32 No. 3rd. St.***

MOTOR GENERATORS

2—New standard General Elec. motor generators on common sub-base, consisting of—
1000 kw., 250 volt no load, 260 volt full load, type "MCF," form "L," with synchronous motors which can be made suitable for any phase or voltage.

1—250 kw., 550 volt, 450 r.p.m. Westgh. generator connected to 320 hp., 2200 volt, 2 or 3 phase, 60 cycle Stanley alternator.

1—100 kw., 125 volt, 580 r.p.m., Westgh. generator only with one bearing suitable for direct connection to a 600 r.p.m. A.C. motor.

1—10 kw., Martin rotary converter, 230 volts to 60 cycles, single phase.

1—7 kw., 125 volt, to 3 phase, 25 cycle, 440 volt, 1500 r.p.m., New, type "MIC" General Elec. outfit.

1—5 kw., 65 volt, 1800 r.p.m., compound wound, Crocker Wheeler generator, direct connected to a 7½ hp., 3 phase motor.

2—350 amp. 70 volt, Crocker-Wheeler generator to 30 hp., 115 volt, 1000 r.p.m. motor, both type "I."

WELDING SET

1—35 hp., 110 volt, 1800 r.p.m., type "L" C. & C. motor direct connected on a common sub-base to a 25 kw. 125 volt, 60 cycle, single phase C. & C. generator.

TRANSFORMERS

4—New Standard General Electric 3500 Kva. each, rated 16500/14850/33000 x 3000 volts, with 2½ and 5% taps.

2—New Standard General Electric 2500 Kva. each, rated 15000/13500/30000 x 2400 volts, with 2½ and 5% taps.

These transformers have 2½ and 5% taps and can be used on other voltage ratios.

1—2½ kw., Westgh. 1 Ph. 60 Cy., 2200 x 110/220 v.
1—5 kw. Pittsburgh, 1 Ph. 60 Cy., 1500/3000 x 110 v.
1—7½ kw. Westgh., 1 Ph. 60 Cy., 2200/1100 x 110/220 v.
8—10 kw. Westgh., 1 Ph. 60 Cy., 2200/1100 x 110/220 v.
2—10 kw. Westgh., 1 Ph. 60 Cy., 2300 x 115/230 v.
1—15 kw. G. E. 1 Ph., 60 Cy., type "H," (Subway), 1040/2080 x 115/230 v.
1—25 kw. G. E. 1 Ph., 60 Cy., type "H," 575/215 v.
2—110 kw. Westgh. 1 Ph., type "OISC," 2200 x 180 v.

BELTED ALTERNATORS

1—20 kw., 110 v., 1800 r.p.m., 60 cycle, single phase, C. & C. alternator with exciter. Can be rewound for 220 v.
1—150 kw. Ft. Wayne, type "ARB," 3 phase, 60 cycle, 2300 v., 600 r.p.m., complete with rails, pulley and exciter.
1—150 kw., Crocker-Wheeler, 3 phase, 60 cycle, 2300 v., 900 r.p.m., complete with rails, pulley and exciter.

D.C. DIRECT CONNECTED SETS

1—75 kw., 250 v., 270 r.p.m., form "F," General Elec. generator to 14 x 14 Ames engine.
1—75 kw., 250 v., 265 r.p.m., Westgh., generator to 13 x 14 heavy duty Erie Ball engine.
1—100 kw., 125/250 v., General Elec., 3 wire, generator 200 r.p.m., direct connected to 15 x 24 Fitchburg, 4 valve engine complete with balancing transformer and switchboard.
1—10 kw., 125 v., Sturtevant Vert. unit, 295 r.p.m., 7 x 8.
1—12 kw., 125 v., Sturtevant Horizontal unit, 8 x 8.
2—15 kw., 125 v., 400 r.p.m., G.E. Marine units.
1—40 kw., 125 v., G.E. to 12 x 12 Ames engine.
1—75 kw., Thompson-Ryan generator to McEwen engine, 14 x 14, 275 r.p.m.
1—125 kw., Ridgway Dyn. and Eng. Co's unit.

DIRECT CURRENT GENERATORS

Compound wound unless otherwise noted

1—6 kw., 125 v., Diehl, type "E," 1200 r.p.m.
1—12 kw., 125 v., Diehl, type "CC," 275 r.p.m.
1—17 kw., 125 v., Diehl, type "E," 950 r.p.m.
1—17½ kw., Gen. Elec., 125 v., type "MP," 1200 r.p.m.
2—20 kw., C. & C., 125 v., 325 r.p.m.
1—25 kw., 125 v., Westgh., type "SK," 1150 r.p.m.
2—27 kw., 125 v., Crocker-Wheeler, type "D," 1125 r.p.m.
1—27½ kw., 125 v., Westgh., type "SK," 925 rpm.
1—30 kw., 125 v., Gen. Elec., type "H," 975 rpm.
1—35 kw., 125 v., Triumph, 600 r.p.m.
1—50 kw., 125 volt, Western Elec., 975 r.p.m.
2—75 kw., 125 v., Westgh., type "S," 720 r.p.m.
1—85 kw., 125 v., Gen. Elec. type "H," 720 r.p.m.
1—100 kw., 125 v., Westgh., single bearing for direct connection, 580 r.p.m.
1—100 kw., 125 v., Western Elec., 3 bearing, type "L4G" 550 r.p.m.
1—200 kw., 125 v., Gen. Elec. type "L," 425 r.p.m.
1—7 kw., 250 v., Gen. Elec. type "H," 1800 r.p.m.
1—30 kw., 250 v., Westgh. type "M," 900 r.p.m.
1—70 kw., 250 v., Westgh. type "S," 875 r.p.m.
1—125 kw., 250 v., Willey, 550 r.p.m.
1—125 kw., 250 v., type "M," Westgh., 225 r.p.m.
1—250 kw., 550 v., Westgh. 450 r.p.m.

3-PHASE, 60-CYCLE MOTORS

1—15 hp., Allis-Chalmers, 550 v., type "3K," 1150 r.p.m.
1—15 hp., Westgh., 550 v., type "CS," 1740 r.p.m.
6—25 hp., G. E., 220/440 v., type "KT," 1200 r.p.m.
1—25 hp., Fbks. Morse, vert. 220/440 v., type "UH," 900 r.p.m.
1—25 hp., Crocker-Wh. Sl. Rg. 550 v., type "Q," 1140 r.p.m.
5—30 hp., G. E., New, 220/440 v., type "KT," 1200 r.p.m.
3—30 hp., G. E., 220/440 v., type "KT," 1800 r.p.m.
1—30 hp., Wagner, New, 220/440 v., type "BP," 850 r.p.m.
3—30 hp., Westgh., 220/440 volt, type "CS," 1160 r.p.m.
1—30 hp., Westgh., 220 v., type "CCL," 840 r.p.m.
1—35 hp., G.E. 220/440 v., type "KT," 900 r.p.m.
3—35 hp., Westgh., 220/440 v., type "CS," 1160 r.p.m.
1—35 hp., Westgh., 550 v., type "CS," 1170 r.p.m.
1—40 hp., Westgh., 550 v., type "CS," 1200 r.p.m.
2—40 hp., Westgh., Sl. Rg. motor only, 220/440 v., type "HF," 870 r.p.m.
1—40 hp., Allis-Chalmers, Sl. Rg. 550 v., 900 rpm.
1—50 hp., Triumph, 220/440 volt, 720 r.p.m.
1—50 hp., C.W., 220/440 v., type "Q," 900 r.p.m.
1—50 hp. G.E., 550 v., type "IK," 1800 r.p.m.
1—50 hp. W.E. 220/440 v., type "KT," 900 r.p.m.
1—75 hp. G.E. New, 2200 v., type "M," 900 r.p.m.
3—75 hp., Westgh., 550 v., type "CS," 870 r.p.m.
1—75 hp., Allis-Chalmers, 550 v., 690 r.p.m.
1—100 hp., General Elec. New, 440 v., type "KT," 720 r.p.m.
1—150 hp., Westgh., 220 v., type "CS," 1200 rpm.
1—350 hp., Westgh., 2200 v., type "CW," 350 rpm.

INDEPENDENT ELECTRIC MACHINERY CO.

CENTRAL STREET and GOODRICH PLACE, KANSAS CITY, MO.

All Apparatus Listed Below in Stock for Prompt Shipment

3 PH., 60 CYCLE, 220 VOLT MOTORS

No.	Hp.	Make	Speed
1	5	Robbins & Myers, New, Elevator	1200
1	5	Gen. Elec., slip ring, New	1620
2	10	Gen. Elec., slip ring, New	1120
1	10	Gen. Elec., Rebuilt	1800
3	15	Robbins & Myers, New	1150
1	15	Robbins & Myers, New	850
6	20	Robbins & Myers, New	1150
1	20	Gen. Elec., Sl. Rg., New	1135
3	25	Gen. Elec., Rebuilt	1200
1	25	Lincoln, 2200-v., Sl.Rg., Re	1200
3	30	Allis-Chalmers, Rebuilt	860
1	30	Western Electric, Rebuilt	900
1	30	Gen. Elec., Slip Ring, New	900
3	30	Gen. Elec., S.C., Rebuilt	1200
4	30	Robbins & Myers, New	1150
1	35	Wagner, Rebuilt	1730
7	40	Watson, Rebuilt	1200
1	40	Allis-Chalmers, Rebuilt	865
1	40	Bullock, Rebuilt	850
5	40	Watson, New	1200
1	50	Gen. Elec., Sl. Rg., New	1200
1	50	Allis-Chal., 2200-v., Re	865
1	50	Allis-Chal., 2200-V., New	865
1	75	Allis-Chalmers, Rebuilt	900
1	75	Ft. Wayne, 2200-V., Re	900
1	100	Gen. Elec., Sl. Rg., Re	1170
1	150	Gen. Elec., S. Rg., Re	695

220 VOLT D C MOTORS

	Hp.	Make	Speed
1	20	Gen. Elec.	650
3	30	General Elec.	1500
1	30	Westinghouse, New	1420
1	35	Crocker-Wheeler	750
1	75	Westinghouse	450
1	110	Crocker-Wheeler	660

DIRECT CONNECTED SETS

1—25-kw. General Electric, 250 volt Generator, compound, 3600-r.p.m., direct connected to Curtis steam turbine.

1—30-kw., 220-volt, 300-r.p.m. Sprague Generator, direct connected to 10 x 10 Ideal steam engine.

1—36-kw. Westinghouse 120-volt, 720-r.p.m. Generator, direct connected to 55-hp., 25-cycle motor.

1—40-kw. Westinghouse 80 to 160-volt, 720 r.p.m. Generator, direct connected to 60 hp., 3-phase, 220-volt, 25 cycle motor.

1—50-kw., 125-volt, 280-r.p.m. General Electric Generator, direct connected to 11 x 12 G. E. Marine steam engine.

1—75-kw. General Electric 250-volt, 300-r.p.m. Compound Generator, direct connected to Ballsteam engine

1—100-kw., 220-volt, 400-amp., 255-r.p.m., 3-wire Western Electric Generator, direct connected to a Fitchburg tandem steam engine.

1—150-kw., 220-volt, 255-r.p.m Western Electric Generator, direct connected to Fitchburg tandem compound steam engine.

1—400-kw., 220-volt, 240-r.p.m. Western Electric Generator, direct connected to Monarch tandem compound engine.

110 VOLT D C GENERATORS

	Kw.		Speed
1	15	Allis-Chalmers	1100
1	17½	Westinghouse	1125
1	30	Fairbanks-Morse	950
1	50	Westinghouse	850

220 VOLT D C GENERATORS

	Kw.		Speed
1	15	Peerless	1360
1	15	Gen. Elec.	1200
1	60 kw.	Commercial	700
1	75	Westinghouse	285
1	80	Milwaukee	650
1	125 kw.	Ft. Wayne	600

3 PH., 60 CY. ALTERNATORS

1—25-kva., 120-volt, 1800-r.p.m. Ft. Wayne, self-excited.

1—50-kw., 220-volt, 60-cycle, 3-phase, 3600-r.p.m. Burke Alternator, direct connected to 50-kw. turbine, complete.

1—62½-kw. 2200-volt, 60-cycle, 3-phase, 300-r.p.m. Bullock Alternator, direct connected to an Aimes steam engine, all complete.

1—75-kva., 2300-volt, 1200-r.p.m., 60-cycle, 3-phase Western Electric Alternator, complete.

1—80-kva., 2300-volt, 60-cycle, 3-phase, 225-r.p.m. Ft. Wayne Alternator, direct connected to 110-hp., Buckeye producer gas engine complete.

2—100-kw., 440-volt, 60-cycle, 3-phase, 3600-r.p.m. General Electric Curtiss type turbines, complete with jet condensers for each machine, driven by steam pumps, two synchronous motor generator exciter sets, one Curtiss turbine exciter set, all complete with necessary rheostats and nine-panel switchboard.

NEW CROCKER-WHEELER TRANSFORMERS

12—20-kva., 2200/220-110-volt, 60-cycle, 1-phase, Transformers, with oil.

3—40-kva., 2200/220-110-volt, 60-cycle, 1-phase Transformers, with oil.

9—50-kva., 2200/220-110-volt, 60-cycle, 1-phase Transformers with oil.

MOTOR GENERATOR SETS

1—125-volt, 40-amp. Triumph Balancer set.

2—Standard R. & M., 300-watt, 30 to 110-volt, battery charging sets.

1—250-watt, G.E—MIC, 24-volt, 10.4-amp., direct connected to 110-volt, 60-cycle, 1-phase motor.

1—10-kw., Martin Rotary Converter, 115-volt, D.C., 230-volt, 3-phase, 60-cycle.

1—20-kw. Crocker-Wheeler, 3-phase, 60-cycle motor, direct connected to 13-kw., 125-volt, comp. generator.

1—36-kw., 120-volt, 720-r.p.m. Westinghouse generator, direct connected to 50-hp., 3-phase, 25-cycle motor.

1—40-kw. Westinghouse 80/160-volt generator, direct connected to 60-hp., 3-phase, 25-cycle, 220-volt motor.

500 VOLT MOTORS

	Hp.	*Make*	*Speed*
1	10	Westinghouse	925
1	19½	West. Elec.	1200
1	30	General Electric	1020
1	50	General Electric	600

Whatever Your Power Problem May Be—We Give it Our Careful Attention

OUR STOCK IS CONSTANTLY CHANGING

PAUL STEWART AND COMPANY

FIRST NATIONAL BANK BLDG. ELECTRIC AND STEAM MACHINERY CINCINNATI, OHIO U.S.A.

FOR IMMEDIATE SHIPMENT

Serviceability and Rush Delivery Assured

TURBINES

2—1250 k.w. Westinghouse Condensing or Non-Condensing or Bleeder type, 60 Cycle, 3 Phase, 480, 2300 or 11,000 Volts.

1—1500-2200 k.w. General Electric Curtiss Vertical 4 Stage Condensing Turbo-Alternator Unit, 60 Cycle, 3 Phase, 2300 or 4000 Volts, 900 r.p.m. Complete with Surface Condenser and all fittings and Auxiliaries.

CONDENSERS

2—8000 sq.ft. Wheeler Admiralty type, Surface Condensers, without Auxiliaries.

1—5700 sq.ft. Worthington, complete with all Fittings and Auxiliaries.

1—5400 sq.ft. Wheeler Admiralty type Condenser complete with all Fittings and Auxiliaries.

A. C. UNITS

1—200 k.w. G. E., 60 Cycle, 3 Phase, 2300 Volts, D. C. to Tandem Compound Automatic Engine, 150 r.p.m. complete.

1—325 kva. Revolving Field E. T. Alternator only, 60 Cycle, 3 Phase, 2300 Volt, 164 r.p.m.

2—330 k.w. Westinghouse R. F. Engine type Alternators, 25-30 Cycle, 3 Phase, 400-440 V., D. C. to Cross Compound Allis Corliss Engine.

1—400 k.w. Crocker-Wheeler Revolving Field Engine type Alternator, 60 Cycle, 3 Phase, 220-440 Volt, 225 r.p.m. No Engine.

ALTERNATORS

1—240 kw. General Electric, Revolving Feld Engine type Alternator, 60 Cycle, 3 Phase, 220-440 Volts, D.C. to Ames Tandem Compound Condensing Engine.

1—300 kva., Allis-Chalmers, Revolving Field Engine type Alternator, 60 Cycle, 3 Phase, 220-440 Volts, D.C. to Skinner Heavy Duty Automatic Engine.

1—1200 kw. Westinghouse, Rev. Field, 60 Cycle, 3 Phase, 440 Volt Alternator, D.C. to Cross Compound Heavy Duty Corliss Engine, 90-day delivery.

ALL APPARATUS IN GOOD CONDITION THE FIRST ESSENTIAL

Power Machinery Exchange

1 MONTGOMERY STREET, JERSEY CITY, N. J.

A.C. DIRECT CONNECTED UNITS

375 KVA G. E. 3 ph., 60 cy., 2300 V. alternator with Curtiss horizontal turbine with dir. con. exciter, switchboard and condenser, (seen operating) immediate delivery.

250 KVA Al. Chal., 3 ph., 60 cy., 2300 V. (or 440-220 V.) with Hamilton heavy duty engine, 200 r.p.m.

250 KVA. Al. Chal. 3 ph., 60 cy., 440-220 V. with Buckeye 18 x 30 heavy duty engine, 120 R.P.M.

175 KW Al. Chal. 2 or 3 ph., 60 cy., 2300 V. (or 440-220 V.) with Al. Chal. 16 x 30 heavy duty Corliss engine, 150 R.P.M.

100 KW Al. Chal., 3 ph., 60 cy., 2300 V. (or 440-220 V.) with Erie Ball side crank, 12 x 14 engine.

100 KVA C W. 2 or 3 ph., 60 cy., 2300 V. (or 440-220 V.) with Ridgway 14 x 12 engine.

90 KVA G. E. 3 ph., 60 cy., 2300 V. (or 440-220 V.) with Chuse Uniflow engine, 14 x 16, side crank, (seen operating).

75 KVA G. E. 3 ph., 60 cy., 2300 V. (or 440-220 V.) with Harrisburg 13 x 14, side crank engine.

60 KVA Elec. Mchy. 3 ph., 60 cy., 2300 V. (or 440-220 V.) with Skinner 11 x 12 engine.

DIRECT CURRENT UNITS

325 KW Wghse. 250-125 volt, with Cooper Corliss engine.

300 KW C.-W. 250 volt, 12 pole, with Watts Campbell cross comp. engine (seen operating).

300 KW, 250 KW, and 200 KW, G. E. 125 volt generators with Fleming 4 valve engines.

200 KW Wghse. 250 volt, 8 pole, with Erie Ball engine.

100 KW Wghse. 125 volt, 8 pole, with Skinner 15 x 16 engine.

75 KW, 60 KW, 50 KW, 40 KW, 30 KW, 25 KW, 20 KW, 15 KW, 10 KW, 7 KW and 2½ KW direct connected units.

MOTOR BARGAINS

	Each
50—½ H.P. Wagner	$65.00
75—½ H.P. G. E., Type RSA	65.00
10—2 H.P. Wagner	125.00
10—3 H.P. Wagner	150.00

All New, Single Phase, 110-220 Volt, 60 Cycle 1750 R.P.M.

IMMEDIATE SHIPMENT

Take As Many As You Want, 25% Cash With Order.

Quan.	H.P.	Make	Phase	Speed	Volts
15	½	G.E.	3	1800	220
8	3	G.E.	3	1800	220
5	10	C.W.	2	1200	220
3	15	C.W.	2	1200	220
25	15	G.E.	3	1200	220
1	30	G.E.	3	1800	220
1	50	G.E.	3	900	440
1	50	Wes.	3	900	440

MONARCH ELECTRIC MOTOR CO., 166 Centre St., New York

Phone: 1240 Franklin ***Motors Bought Anywhere—Any Size***

ELECTRICAL MACHINERY—Stock Shipment

3-Phase, 60-Cycle, 220-440-V MOTORS

No.	Hp.	Make	Type	Speed	
22	15	West. Elec.	KT	900	New
6	15	West. Elec.	KT	1200	New
11	15	West. Elec.	KT	1800	New
20	20	West. Elec.	KT	900	New
3	20	West. Elec.	KT	1200	New
1	20	West. Elec.	KT	1800	New
16	25	West. Elec.	KT	1200	New
1	25	Allis-Chal.	.....	1150	Used
8	30	West. Elec.	KT	1200	New
1	30	Fair.-Morse	B	1200	Used
1	35	Swing	.....	900	Used
9	40	West. Elec.	KT	1200	New
1	40	West. Elec.	KT	1800	New
1	50	Gen. Elec.	KT	600	Used
4	50	West. Elec.	KT	900	New
1	50	West. Elec.	KT	1200	New
1	50	West. Elec.	KT	900	New
4	60	West. Elec.	KT	1800	New
4	75	West. Elec.	KT	1800	New
1	75	West. Elec. 40°	KT	1200	New
1	75	West. Elec.	KT	720	New
2	150	West. Elec.	KT	720	New
1	150	West. Elec.	KT	600	New

3-Phase, 60-Cycle—A.C. SLIP RING MOTORS

3	3	West. Elec.	MTC	1200	New
2	10	West. Elec.	MT8	1200	New
1	15	West. Elec.	.....	900	Used
2	15	West. Elec.	MT9	1200	New
2	20	West. Elec.	MT322	1200	New
1	20	West. Elec.	MT326	900	New
4	25	West. Elec.	MT326	1200	New
1	30	West. Elec.	MT332	1200	New
1	40	West. Elec.	MT332	1200	New
2	40	West. Elec.	MT342	900	New
1	50	West. Elec.	MT346	900	New
1	50	West. Elec.	MT343	1200	New
1	50	West. Elec.	MT14	900	New

DIRECT CURRENT BELTED GENERATORS

Kw.	Volts	Make	Type	Speed
7½	115	Fair.-Morse	CP	1350
7½	250	Fair.-Morse	CP	350
10	125	Elec. Mach.	.....	1200
12½	125	Triumph	.....	1400
12½	125	Fair.-Morse	CP	1100
15	125	Sturtevant	.....	500
18	125	Westinghouse	.....	800
33	125	Milwaukee	.....	1125
100	250	Goodman	.....	600
400	250	West. Elec.	L	375

220 VOLT DIRECT CURRENT MOTORS

No.	Hp.	Make	Type	Speed	
5	2	West. Elec.	RC	1700	New
1	2	West. Elec.	RC	1150	New
18	3	West. Elec.	RC	1700	New
2	3	West. Elec.	RC	1150	New
1	3	West. Elec.	RC	850	New
1	5	West. Elec.	RC	1700	New
1	5	West. Elec.	E2	1100	Used
1	5	West. Elec.	RT	650/1950	New
1	5	Allis-Chalmers	.....	575/1450	Used
4	7½	West. Elec.	RC	1700	New
1	7½	West. Elec.	RC	1150	New
1	10	Peerless	.....	1150	Used
1	10	Peerless	.....	1800	Used
3	10	West. Elec.	RC	1150	New
1	15	West. Elec.	RC	1700	New
5	15	West. Elec.	RC	1150	New
6	20	West. Elec.	RC	1150	New
2	25	West. Elec.	RC	1150	New
1	25	Wiley Elec.	.....	890	Used
1	40	Westinghouse	SK	750	Used

ENGINE GENERATOR SETS

2—50-kw., 115/125-volt, 275-r.p.m. West. Elec., type L-4, comp. wd., 6-pole, direct current, direct connected to 12 x 12 center crank, simple automatic ball engine.

1—150-kw., 250-volt, 9000-r.p.m. DeLaval, comp. wd. turbine, direct connected to 2—75-kw., 900-r.p.m. Mill Generators.

1—200-kw., 240-volt, 200-r.p.m. Gen. Elec., type TRE, form D, Frame 36, 3-phase, 60-cycle, with exciter for direct connection.

1—250-kva. Westinghouse, 240-volt, 200-r.p.m., 3-phase, 60-cycle Generator, direct connected to 15½ x 27 x 21 Tandem compound Erie City crank side, 4-valve, left-hand auto. Corliss engine.

1—250-kw., 2300-volt, 3-phase, 60-cycle, 200-r.p.m. General Electric, type ATB Generator, direct connected to 20 x 22 simple automatic slide valve Chandler & Taylor engine. Fly wheel, 10 ft. x 18 in. Complete with switchboard exciter, oiling system fittings and trimmings.

1—360-kw., 2300-volt, General Electric, 150-r.p.m., type TRE, 3-phase, 60-cycle, direct connected to 20 x 36 Rice & Sargent, 4-valve non-releasing Corliss engine. Fly wheel, 12 ft. x 13 in., complete with Rites speed regulating device, force feed lubrication exciter, switchboard, fittings and trimmings.

A.C. BELTED TYPE GENERATORS 3-Phase, 60-Cycle

Qu.	Kw.	Kva.	Make	Type	Volt	Speed
1	31½	...	Gen. Elec.	ATB	240	1200
1	75	...	Westinghouse	.....	2300	720
1	85	...	West. Elec.	S15	2300	900
2	115	...	Allis-Chalmers	.....	2300	900
2	150	...	Gen. Elec.	ATB	2300	600
1	150	...	Allis-Chal.	.....	2300	600
1	175	...	Allis-Chal.	.....	480	600
1	200	...	Gen. Elec.	ATB	2300	720
1	250	...	Westinghouse	.....	240	200
1	300	...	Gen. Elec.	ATB	480	720

MOTOR GENERATOR SETS

1—12½-kw., 125-volt Triumph Electric Interpole 1200-r.p.m., direct connected to 3-phase, 60-cycle, new General Electric motor on base.

1—18-kw., 125-volt Westinghouse, 900-r.p.m., direct connected to 3-phase, 60-cycle new General Electric motor on base.

1—33-kw., 125-volt Milwaukee, 1200-r.p.m., direct connected to 3-phase, 60-cycle New General Electric motor on base.

1—37½-kw., 125-volt Westinghouse, 900-r.p.m. direct connected to 3-phase, 60-cycle, new General Electric slip ring motor, complete with battery charging board, 3-circuit panel field rheostat and complete equipment.

1—100-kw. Goodman Mfg. Co., 220-volt, 600-r.p.m., direct connected to 3-phase, 60-cycle new General Electric slip ring motor on base.

OIL ENGINE SETS

1—45-kw., 125/250-volt, D.C. Sprague (G. E.) 400 r.p.m., 3-wire Generator, direct connected to 4-cylinder, 70-hp. horizontal Olds engine, built by Seagar Engine Works, Lansing, Mich., complete with switchboard, fittings and trimmings.

1—35-kw., 125/250-volt, D.C. Westinghouse, SK, 675-r.p.m., belted to 70-hp., 4-cylinder horizontal Olds engine, complete with switchboard fittings and trimmings.

1—22½-kw., 125/250-volt Sprague, D.C., type C Generator, direct connected to 40-hp., 2-cylinder horizontal engine, with switchboard fittings and trimmings.

1—100-kw., 2300-volt G. E., 3-phase, 60-cycle, Type A.T.B., 275-r.p.m., direct connected to 13 x 16, non-releasing, 4-valve Chuse Corliss Engine. Complete with switchboard, exciter and fittings.

Write or wire for specifications and quotations, also when you have equipment for sale.

Long Distance Phone: Haymarket 8166

CHICAGO ELECTRIC CO., 740 W. Van Buren St., Chicago, Ill.

Reliable—POWER PLANT MACHINERY

STEAM ENGINES

1—17 x 34 x 48 Hamilton, cross compound, heavy duty Corliss, designed for rope drive.
1—16 x 34 x 48 Hamilton, tandem compound, heavy duty Corliss, designed for rope drive.
6—18 x 36 Allis-Chalmers, heavy duty Corliss.
1—18 x 24 Atlas automatic, four-valve.
1—16 x 42 Allis-Corliss.
1—14 x 30 Hamilton, heavy duty Corliss.
1—16 x 22 Houston, Stanwood & Gamble, slide valve.
1—14 x 18 Erie City automatic.
1—14 x 16 Brownell, slide valve.
1—13 x 16 Erie City automatic.
1—12 x 12 Erie City automatic.
1—11 x 15 Erie automatic.
1—12 x 16 Chandler & Taylor, slide valve.
1—10 x 12 Chandler & Taylor, slide valve.
1— 9 x 16 Lane & Bodley, slide valve.
1— 9 x 9 Industrial vertical.
1— 8 x 8 Industrial vertical.
1— 6 x 8 horizontal slide valve.
1— 4 x 5 Clark vertical.

BOILERS

3—520-hp. B. & W., A.S.M.E. code, 250 lb. pressure (new).
4—250-hp. B. & W., 150-lb. pressure.
2—250-hp. Sterling, 150-lb. pressure.
4—200-hp., 84 x 18, high pressure return tubular.
4—150-hp., 72 x 18, high pressure, return tubular.
1—140-hp., 78 x 14, high pressure, Ohio standard.
1—125-hp., 72 x 16, high pressure, return tubular.
1—100-hp., 66 x 16 horizontal return tubular.
1—80-hp., 60 x 16, high pressure, Ohio standard.
1—60-hp., 54 x 14, high pressure, return tubular.
1—50-hp., 48 x 14 horizontal return tubular.
3—25-hp., 42 x 95, new, A.S.M.E. code, vertical 125 lb.
1—15-hp., 36 x 83 new A.S.M.E. code vertical, 100 lb.
1—10-hp., 30 x 83 new Ohio standard vertical, 100 lb.

A. C. MOTORS

3-Phase, 60-Cycle, Squirrel Cage and Slip Ring

No.	Hp.		Make	Volt	Rpm.
6	2	New	Westinghouse	220	1200
4	5	New	G. E.	220	1200
6	7½	New	G. E.	220	1800
10	10	New	G. E.	220	1200
1	10	New	Westinghouse	220	870
6	15	New	G. E.	220	1200
2	15	New	G. E. (slip ring)	220	1200
1	20	Used	Fairbanks-Morse	220	1200
13	20	New	G. E.	220	1200
6	25	New	G. E.	220	1200
2	25	New	G. E. (slip ring)	220	1200
7	30	New	G. E.	220	1200
2	30	New	G. E.	220	900
6	40	New	G. E.	220	1200
2	40	New	G. E.	220	900
3	40	New	G. E.	440	600
2	40	New	G. E. (slip ring)	220	1200
4	50	New	G. E.	220	900
1	60	New	G. E.	220	900
2	50	New	G. E. (slip ring)	220	1200
2	75	New	G. E.	220	900
2	100	New	G. E.	220	900
1	100	Used	Westinghouse	220	1200
1	150	Used	Westinghouse	2200	720
1	250	New	Allis-Chalmers	2200	500

Any of the above 220-volt Motors can be furnished for 440-volt and vice versa.

D. C. GENERATORS
Belted and Direct Connected

1—17½-kw. Triumph, 125-volt, compound wound, D.C. Generator, direct connected to an 8 x 8 Troy vertical automatic Engine.
1—17½-kw. Westinghouse, 125-volt, D.C., compound wound Generator, direct connected to a 7 x 8 Erie Ball, enclosed type automatic engine on sub-base.
1—22½-kw. Allis-Chalmers, 120-volt, D.C., compound wound Generator, 925-r.p.m.
1—50-kw. Allis-Chalmers, 125-volt, 275-r.p.m., D.C., compound wound Generator, direct connected to a Skinner uniflow automatic engine on sub-base.
1—50-kw. Allis-Chalmers, 240-volt, D.C., compound wound Generator, direct connected to a 10 x 12 Erie Ball automatic engine.
1—65-kw. Jantz & Leist, heavy type, 125-volt, compound wound, D.C. Generator, direct connected to a Skinner automatic slide valve engine.
1—75-kw. General Electric, 125-volt, 275-r.p.m., compound wound, D.C. Generator, direct connected to a 14½ x 14 Russell automatic engine on sub-base.
1—100-kw. Triumph, 125-volt, 675-r.p.m., compound wound, belted type Generator.
1—150-kw. Northern Electric Co., 250-volt, D.C., compound wound Generator, direct connected to an 18 x 18 Skinner automatic slide valve engine on sub-base.

A. C. GENERATORS
Belted and Direct Connected

1—800-kw. Allis-Chalmers, 3-phase, 60-cycle, 480-volt Alternator, direct connected to a 26 x 44 x 48 cross compound Allis-Chalmers Corliss Engine.
1—500-kw. General Electric Curtis, vertical, 3-phase, 60-cycle, 2300-volt, 1800-r.p.m. Turbo Generator Set, with Wheeler condenser.
1—375-kva., 3-phase, 60-cycle, 4000, 2000 or 480-volt, 150-r.p.m. Allis-Chalmers Alternator, direct connected to a 21 x 30 Fleming-Harrisburg enclosed type Corliss valve, heavy duty Engine.
2—New 312-kva., 3-phase, 60-cycle, 2300-volt Western Electric Alternators, each direct connected to a new 18 x 24 Corliss Engine.
1—150-kw. Allis-Chalmers, 3-phase, 60-cycle, 2300-volt Alternator, 150-r.p.m., direct connected to a 14 x 30 heavy duty Allis-Chalmers Corliss Engine.
1—125-kw. Ft. Wayne, 3-phase, 60-cycle, 1150-volt, 257-r.p.m. Alternator, direct connected to a 14 x 20½ x 16 Skinner tandem compound automatic slide valve Engine.
1—90-kva. Electric Machinery Co., 3-phase, 60-cycle, 220-volt, 1200-r.p.m. revolving field, belted type Alternator.
1—56.2 kw. Western Electric, 3-phase, 60-cycle, 240-volt, 1200-r.p.m. revolving field, belted type Alternator.

OUR SHOPS AND EXPERIENCE ARE AT YOUR SERVICE

THE RANDLE MACHINERY COMPANY *Established 35 Years*

Located ONLY at **1822 POWER ST., CINCINNATI, OHIO**

Under the Fairbanks O.K.

Electric Motor Stocks

from 28 Branch Houses

Lincoln
2 and 3 Phase, 50 H.P. to ½ H.P.

Wagner
1 Phase, 10 H.P. to ½ H.P.

Westinghouse
Direct Current 50 H.P. to 1/6 H.P.

Available for Immediate Delivery

Prices Right ***Trade Discounts***

35 and 40 degree rating

THE FAIRBANKS CO., 416 Broome St., New York

JOHN A. STEWART ELECTRIC CO.

1814 Continental Bank Bldg. Chicago, Ill. | **408 First Nat. Bank Bldg. Cincinnati, O.** | **2112 Central Street Kansas City, Mo.**

TURBINES

3—500 kw. Gen. Elec. Vertical, 3 ph., 60 cy. 1800 r.p.m. 2300 v. with 2000 sq. ft. Surface Condenser, with piping to headers. Beautiful condition. Immediate delivery.

2—400 kw. Westinghouse Bronze Bladed. 2 or 3 ph., 60 cy., 3300-2300-550-480 volts, 3600 r.p.m. condensing with 2500 sq. ft. Surface condenser.

FREQUENCY CHANGERS

3—200 kw. G. E. 3 ph., 25 cy., 6000 v. to 3 ph., 60 cy., 2400 v. 750 r.p.m. four bearing can be separated making 2 motors.

1—400 kw. G. E. same as above 375 r.p.m.

1—500 kw. G. E. same as above 375 r.p.m.

CONDENSERS

2—Westinghouse No. 11 Le Blanc Low Level Jet Condensers, complete with Motor driven pumps, strainers and piping. Used one year and now in perfect condition. Good as new. Immediate delivery Cincinnati.

GENERATOR AND ENGINE

1—240 kw. Ft. Wayne 3 ph., 60 cy., 2300 v. 150 r.p.m. revolving field with belted exciter, direct connected to 13 x 27 x 24 Russel Tandem Compound 4 Valve heavy duty Engine. Excellent condition. Immediate shipment Cincinnati.

MOTORS

1—1400 hp. Westinghouse type C. W. Slip Ring Rolling Mill Type motor, 3 ph., 60 cy., 2300 v. 505 r.p.m. with magnetic control panel complete. This motor is brand new and in original crate.

1—1250 kva. Westinghouse Synchronous, 6600 v. 3 ph., 25 cy. 450 r.p.m. with starting motor.

1—750 hp. New Allis-Chalmers, 3 ph., 60 cy., 2200 v. Slip Ring 505 r.p.m. With starter.

1—300 hp. New Allis-Chalmers, 3 ph., 25 cy., 440 v., 485 r.p.m. Slip Ring Induction Type with base and drum control.

1—250 hp. New. G. E. 3 ph., 60 cy., 550 v. 600 r.p.m. Squirrel Cage 40°.

BOILERS

2—480 hp. Sterling Water Tube. Code built 160 lb. working pressure and fired grates complete with all fittings.

6—500 hp. Aultman & Taylor, B. & W. boilers with Green Chain Grate Stokers, 175 lb. press.

4—490 hp. Springfield Water Tube. Good for 150 lb. press. Complete with Murphy underfeed stokers and all fittings. Excellent condition. Immediate delivery. Low in price.

20—250 hp. Wicks with Stokers and all fittings. Excellent condition. These boilers can go into Michigan or any other state.

ROTARY CONVERTER

1—500 kw. Westinghouse, 2300 v. A.C. 250 v. D.C. with transformers and Switchboard panels. Fine condition. Immediate shipment.

1—300 kw. Westinghouse 60 cy., 3 ph., 11000 v. A.C., 550 v. D.C. with transformers, A.C. and D.C. panels. Other transformers available for different ratios.

1—400 kw. G. E. 250 v. D.C. 185 v. A.C. 375 r.p.m. no transformers.

1—500 kw. G. E. Same as above.

IMMEDIATE SHIPMENT
New and Used Electrical Equipment
BARGAIN PRICES

ALTERNATING CURRENT MOTORS
3-Ph., 60-Cy. (40-Deg. C).

No.	Hp.	Rev.	Volt	Type	Make
1	1	1200	220/440	K	R. & M.
1	1	1800	220/440	K	R. & M.
1	2	1200	220/440	K	R. & M.
1	2	1800	220/440	K	R. & M.
2	3	1800	220/440	IS	Diehl
2	3	1200	220/440	KT	G. E.
2	5	1800	220/440	K	R. & M.
3	5	1200	220/440	K	R. & M.
1	7½	1200	220/440	K	R. & M.
1	7½	900	220/440	K	R. & M.
1	10	1800	220/440	IS	Diehl
1	15	1200	220/440	K	R. & M.
1	15	900	220/440	K	R. & M.
1	20	1200	220/440	KT	G. E.
1	20	900	220/440	K	R. & M.
1	25	1200	220/440	K	R. & M.
2	30	1200	220/440	K	R. & M.

ALTERNATING CURRENT MOTORS
2-Ph., 60-Cy. (40-Deg. C).

No.	Hp.	Rev.	Volt	Type	Make
2	2	1800	220/440	K	R. & M.
1	2	1200	220/440	K	R. & M.
1	2	900	220/440	K	R. & M.
1	5	900	220/440	K	R. & M.
2	7½	1800	220/440	K	R. & M.
1	10	1800	220/440	K	R. & M.
1	10	1200	220/440	K	R. & M.
1	15	1800	220/440	K	R. & M.
1	20	1200	220/440	K	R. & M.
1	20	900	220/440	K	R. & M.
1	25	1200	220/440	K	R. & M.
1	30	1200	220/440	K	R. & M.

DIRECT CURRENT MOTORS

No.	Hp.	Volts	Rev.	Make
1	5	500	1100	R. & M.
1	7	250	410	Phoenix
1	7½	500	850	Westghse.
1	15	500	650	G. E.
2	15	500	1100	Cr.-Wh.
1	25	230	800	G. E.
1	25	500	800	G. E.
1	35	230	400	G. E.
1	35	230	875	W. E.

MOTOR GENERATOR SETS

1—100-kw., 250/275-volt, 900-r.p.m., Type DLC General Electric, with interpoles direct connected to 1—2300-volt, 3-ph., 60-cy. G. E. Synchronous Motor, with direct connected exciter and new switchboards. Set will be completely overhauled and ready for shipment in 4 weeks.

1—150-kw., 250/275-volt, 514-r.p.m. Gen. Elec., direct connected to 1—225-hp., 2300-volt, 3-ph., 60-cy., Type IQ, form KI. Gen. Elec. Induction Motor, with A.C. and D.C. panels.

1—75-kw., 250-volt, 900-r.p.m. Bullock Generator, direct connected to 1—220-volt or 2300-volt, 3-ph., 60-cy. Gen. Elec. Induction Motor, complete.

SPECIAL

1—750-kw., 2200-volt, 3-ph., 60-cy., 720-r.p.m. Westinghouse Synchronous Motor, with direct connected exciter and starting equipment.

STEAM ENGINE GENERATOR SETS

1—50-kw., 125-volt G. E., direct connected to 1—75-hp. Ball engine with switchboard.

1—22½-kw., 125-volt Westinghouse, direct connected to 1—30-hp. Russel engine with switchboard.

1—75-kw., 125-volt, Westinghouse, direct connected to 1—100-hp. Ball Engine, with switchboard.

1—100-kw., 250-volt Western Electric, direct connected to 1—100-hp. Skinner Engine, with switchboard.

1—150-kw., 250-volt Gen. Elec., direct connected 1—19 x 20 Harrisburg Engine, with switchboard

1—200-kw., 250-volt Westinghouse, direct connected to 1—20 x 21 Erie City Engine, with switchboard.

1—165-kw., 500-volt Crocker-Wheeler, direct connected 1—18 x 19 Harrisburg Engine, with switchboard.

1—600-kw., 250-volt, 500-rev., connected to 1—1000-hp. De Laval Multi-Stage Steam Turbine, complete.

GAS ENGINE GENERATOR SETS

1—50-kw., 250-volt, 260-rev. Ft. Wayne, direct connected to 1—Vertical, 3-cylinder Engine, complete.

1—100-kw., 250-volt Westinghouse, direct connected to 1—Vertical, 3-cylinder Engine, complete.

Send for our stock sheet which lists equipment in addition to the above. Tell us what you have for sale—we may be in a position to use your idle machinery.

MOORHEAD MACHINERY CO.

Office: **522 Pittsburgh Life Bldg. PITTSBURGH, PA.** ***Warehouse:*** **S. 16th & Muriel S t**

CONSOLIDATED WIRE AND MACHINERY CORPORATION
CHICAGO, ILLINOIS.

ENGINE GENERATOR SETS

100-kw. Westinghouse, 3-phase, 220/440/2300 volt, 60-cycle, direct connected to 15 x 14 Skinner engine, 227-r.p.m., with switchboard.

50-kw. Ft. Wayne, 3-phase, 60-cycle, 2300/440-volt, direct connected to 11 x 12 Skinner engine, 227-r.p.m., with exciter and switchboard.

100-kw. Westinghouse, 2-phase, 220-volt, 60-cycle, direct connected to 15 x 14 Skinner engine, 300-r.p.m., with switchboard.

D. C. 250 VOLTS ENGINE GENERATOR SETS

50-kw. Allis-Chalmers Generator, direct connected to 11 x 12 Skinner engine, 275-r.p.m., like new, with switchboard. Floor space 10 x 8 ft.

BELTED GENERATORS A. C.

75-kw. Westinghouse, 2300-volt, 3-phase, 60-cycle, with damper windings and exciter, 900-r.p.m., No. 120273, new.

100-kva. General Electric, 2300-volt, 3-phase, 60-cycle, 900-r.p.m., type ATB, with exciter, switchboard and belt.

150-kw. Westinghouse, 2400-volt, 3-phase, 60-cycle, 600-r.p.m., with damper windings and exciter, new. No. 825078.

150-kw. General Electric, 2300/440-volt, 3-phase, 60-cycle, 600-r.p.m., with exciter. No. 93660, with belt.

BELTED GENERATORS D. C.

50-kw. Western Electric Generator, shunt or compound wound, 125-volt, 675-r.p.m., with switchboard.

33-kw. Western Electric Generator, shunt wound or compound wound, 125-volt, 800-r.p.m., complete with switchboard.

37-kw. Northern, compound wound Generator, 250-volt, 875-r.p.m., complete with switchboard.

37-kw. Westinghouse Generator, compound wound, 250-volt, 1425-r.p.m., complete with switchboard.

3 PHASE, 25-CYCLE, 40° MOTORS IN STOCK

Hp.	Make	Speed
75	Allis-Chalmers	725
65	Allis-Chalmers	1440
60	Allis-Chalmers	720
50	Westinghouse	735
40	Westinghouse (sl. ring)	730
35	Westinghouse	1450
25	Westinghouse	750
20	General Electric	725
15	General Electric	715
10	Westinghouse	1455
10	General Electric	720
7½	General Electric	715
5	Westinghouse	1440
5	General Electric	715
5	General Electric	1425
3	Westinghouse	720
3	General Electric	710
2	General Electric	1450
2	General Electric	430

3 PHASE, 60-CYCLE MOTORS IN STOCK

Hp.	Make	Speed
3	St. Louis	1800
5	St. Louis	1800
5	St. Louis	1200
7½	St. Louis	1800
7½	St. Louis	1200
10	St. Louis	1200
10	St. Louis	1800
15	St. Louis	1200
15	St. Louis	1800
30	Allis-Chalmers	900
40	General Electric	600
50	Fairbanks-Morse	900
50	Allis-Chalmers	900
50	General Electric	900
75	Allis-Chalmers	900
100	Ideal	1200
200	Westinghouse	600

D. C. MOTORS, 220 VOLTS

Hp.	Make	Speed
3	General Electric	1700
4	National	1000
5	Northern	1025
5	General Electric	1700
7½	Northern	340
7½	Reliance	550/1050
10	General Electric	1150
15	General Electric	1100
20	Sprague	1100
35	Peerless	900
50	Northern	825
50	Jenny	780
200	Crocker-Wheeler	130

D. C. MOTORS, 110 VOLTS

Hp.	Make	Speed
4	Sturtevant	1000
5	General Electric	1000
6½	Sturtevant	1100
10	Peerless	1000
40	Western Electric	900
65	Western Electric	575

We carry a complete stock of Bare Magnet, Resistance, Weather-proof, Rubber Covered, Lead Covered Cables and Cords and Insulating Materials

BOILERS

Surplus stock taken over from the Du Pont Chemical Co. and other plants.

PRACTICALLY NEW—Used Six Months to Three Years. Offered Subject to Any Inspection.

No.	Size, Hp.	Make	Pressure, Lb.
8	600	Edge Moor	160
1	813	Edge Moor (A. S. M. E.)	200
		Above located in Du Pont Chemical Company's Plant at Hopewell, Virginia	
1	295	B. & W. (Stirling) located Carney's Point, N. J.	200
2	267	B. & W.	160
2	512	Stirling Class S No. 26	160
2	512	Stirling Class S No. 26	160
4	253	Stirling Class E. No. 22	160
1	823	Stirling M-30 (A. S. M. E.)	200
2	550	Edge Moor	150
2	238	Edge Moor	150
1	234	Edge Moor	150
1	231	Edge Moor (Ohio Standard)	150
1	199	Edge Moor	150
1	100	Smith HRT	100

Above boilers located at Du Pont Chemical Company's Plant Carney's Point, N. J.

MISCELLANEOUS

No.	Size, Hp.	Make	Pressure, Lb.
1	400	Stirling	150
2	400	Wickes	150
2	250	Wickes	165
1	250	Wickes	150
1	300	Wickes	150
1	225	Geary	150
1	250	B. & W.	125
2	210	B. & W.	125
1	600	Scotch Marine	150
6	200	Scotch Marine	160
2	385	Heine	160
1	78 x 20	H.R.T.	115
4	72 x 18	H.R.T.	125
2	66 x 16	H.R.T.	80

STEEL STACKS

1—39 in. x 75 ft. 1—60 in. x 90 ft. 3—36 in. x 60 ft.
1—14 x 36 R. H. Corliss Engine.

We invite your inspection of any of the equipment we have in stock. Inspections can be made at any time. Quotations are made for prompt acceptance and subject to prior sale.

Let us handle your boiler requirements. We overcome high prices and slow deliveries on new boilers. Purchase now and take advantage of this stock which is moving rapidly.

Write or wire for specifications and quotations also when you have boilers for sale.

J. F. DAVIS, Phone Central 1494, 1122-24 Harris Trust Building, Chicago

Dealers Attention!

20% discount on NEW motors up to 20 HP.
17½% discount on NEW motors 25 to 50 HP.
15% discount on NEW motors 60 HP. and up.

General Electric, Westinghouse, Wagner, D.C. and A.C. from our present stock.

Terms 25% with order, balance sight draft.
Send us your inquiries.
Used motors up to 50% discount.
Our one year guarantee protects you.

Largest stock of its kind in America

NATHAN KLEIN & CO.
MOTORS HOWARD & CENTRE STS., N.Y. DYNAMOS

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Each announcement represents a current Want of a concern or individual in the industry with some element of profit in each for whoever can fulfill the need. Some have money saving possibilities, others are opportunities for more business; many are employment opportunities while still others offer chances to buy going businesses, plants, property, etc.

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"Think SEARCHLIGHT First"

0140

MOTORS

60 cycle, 2 and 3 phase

220/440 VOLTS

1—250 hp., New Crocker-Wheeler Slip Ring .....600 r.p.m.
1—200 hp., Westinghouse, type C.....580 r.p.m.
1—200 hp., Crocker-Wheeler .....870 r.p.m.
2—100 hp., Crocker-Wheeler .....1800 r.p.m.
1—100 hp., Crocker-Wheeler .....850 r.p.m.
1— 75 hp., Crocker-Wheeler .....1160 r.p.m.
2— 50 hp., Triumph .....900 r.p.m.
2— 30 hp., Cleveland Elec..... 900 r.p.m.
1— 25 hp., Allis-Chalmers ..... 900 r.p.m.

NEW SINGLE-PHASE CENTURY, 110/220 VOLTS

Prices f.o.b. Pittsburgh

1—5 hp., 1700 r.p.m., Wagner $250
3—3 hp., 1165 r.p.m., $238 each
2—1½ hp., 1165 r.p.m., $157 each
2—1½ hp., 1750 r.p.m., $135 each

Also a stock of various smaller sizes in A.C. and 110, 220 and 500 volts D.C.

Motor-generators — Turbo-generators — Direct connected units—Gas Engines—Boilers—Complete Plants—Ice Machines.

W. A. CARRELL COMPANY
211-213-215 Second Ave., Pittsburgh, Pa.

Bombs

Are bad things to fool with. So are cranky motors. Send for Nelson. Best repair forces in the country.

I. R. NELSON CO.
BOND STREET, NEWARK, N. J.

FOR SALE

Two—300 H. P., 500 Volt

MILL MOTORS

TWO WESTINGHOUSE 300 H.P., 345 to 500 R.P.M., 500 Volt, D.C. COMPOUND WOUND MOTORS, with one spare armature, including two Cutler-Hammer, 300 H.P., 500 Volt, D.C. Starters.

Condition good. Ready for inspection. Reason for selling, voltage changed. Write

H. LLEWELLYN
General Purchasing Agent
PITTSBURGH STEEL PRODUCTS CO.
Union Arcade Building, Pittsburgh, Penna.

MOTORS AND GENERATORS

REWOUND
REPAIRED
and completely
REBUILT

either in our modernly equipped shop or on your own premises.

We send our men anywhere at any time, to make reconnections on Motors or Generators for the changing of phase or voltage without rewinding.

We are noted for the service we render and can furnish coils for practically any Motor or Generator on very short notice, as we have in stock practically any standard size magnet wire required. Send us one of your burned out coils for an estimate. We have a crew of men who are ready to start on your job immediately.

Wire us your electrical troubles. Let them be ours, as we have the outfit to off-set conditions immediately.

Brown-Hunkele Corporation
12-26 Mechanic St., Newark, N. J.
'PHONE: Market 2811, 2812, 2813

Slip Ring Motors

Quick Shipment ***Attractive Prices***

Two and three phase, 60 cycle 220-440-550 volt.

Hp.		*Type*	*R.p.m.*
2—400	Westinghouse	CW	435
1—250	Crocker Wheeler		720
3— 40	Westinghouse	CW	860
1— 30	Westinghouse	HF	900
2— 15	Allis Chalmers		680
8— 10	Otis Elevator		900
3— 10	General Electric		900
1— 10	General Electric		1200
2— 7½	Westinghouse	CW	1200
1— 7½	Westinghouse	HF	1200
6— 7½	General Electric		900

These motors have seen very little service, have been rebuilt and thoroughly tested, and carry our guarantee to be practically good as new, and free from electrical and mechanical defects.

Write for our list of a.c. and d.c. motors. Our stock is very complete.

Get acquainted with our "Square Deal Methods"

R. SCHEINERT CO.
123-25 N. Third St. Philadelphia
To Buy or Sell—Phone, Write or Wire

25-Cycle Generators

Immediate Shipment

Attractive Prices

1—240 kw., 187 r.p.m., type "ATB" engine type generator (rotor and stator only).

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2	2	Allis-Chalmers	440	1135
2	3	Allis-Chalmers	440	850
2	5	Lincoln	220	900
5	5	Allis-Chalmers	440	860
1	5	Allis-Chalmers	220	1700
1	5	Western	220	1140
2	6	Lincoln	220	1200
2	7½	Lincoln	220	900
1	7½	Crocker-Wheeler	440	860
1	7½	Allis-Chalmers	440	860
1	10	Lincoln	220	600
1	10	Lincoln	220	800
1	10	General Electric	440	720
2	10	Allis-Chalmers	440	680
1	10	Allis-Chalmers (new)	440	860
1	10	Crocker-Wheeler	440	670
1	15	Allis-Chalmers (new)	440	860
1	15	Crocker-Wheeler	440	850
1	15	Allis-Chalmers	440	680
1	20	Allis-Chalmers	440	1160
1	20	Allis-Chalmers	440	860
1	25	Lincoln	220	1800
1	25	Lincoln	220	900
1	25	Westinghouse	220	575
1	25	Westinghouse	220	1200
1	35	Westinghouse	220	1170
1	40	Bullock	440	850
1	40	Westinghouse	440	1745
1	50	Westinghouse	220	565
1	75	General Electric	440	715
1	75	Crocker-Wheeler, slip ring	440	965
1	75	Western, slip ring	440	860
1	75	General Electric	220	865
1	100	Allis-Chalmers (new)	440	900
1	100	Crocker-Wheeler, slip ring	440	965
1	100	Allis-Chalmers	2200	720
1	200	Allis-Chalmers	440	600
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1	40	220	1200	H	Fairbanks Morse Co.
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1	50	220	1200	H	Fairbanks Morse Co.
1	50	440	850	AN	Allis-Chalmers
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3—25 hp. Wagner Type B.W. Self-Starting Motors, 3 ph., 440 v, 850 r.p.m.
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1	7½	850	Fairbanks-Morse, sl.rg.	Rebuilt
4	10	1800	Triumph	New
2	10	1800	Fairbanks-Morse	Nearly new
14	15	1800	Fairbanks-Morse	New
1	15	1800	Fairbanks-Morse	New
4	20	1800	Triumph	New
1	20	1200	Triumph	New
1	25	1800	Fairbanks-Morse	New
1	25	1800	Fairbanks-Morse	New
4	25	1200	Triumph	New
1	25	1200	General Electric	Rebuilt
1	30	1155	General Electric	Rebuilt
1	30	900	Allis-Chalmers	Rebuilt
2	30	900	Crocker-Wheeler	New
3	35	1800	Fairbanks-Morse	New
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1	50	600	General Electric	Rebuilt
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	Hp.	Make	Type	Volt	Rpm.
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2—	25	Westinghouse	CS	220	720
3—	25	Westinghouse	CS	220	900
1—	30	Crocker-Wheeler	Sq. Cage	2200	900
3—	50	General Electric	L	220	900
1—100		General Electric	L	550	720
1—200		General Electric	L	550	600

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HORIZONTAL MOTORS

In Good Condition

1—1 hp., 115 volt, D.C., size E. type CCM, RPM 1250, plus 5%, 8.4 Amp. No. 23333.
1—1 hp., 115 volt, RPM. 1250, plus 5%, size E. type CCM, Amp. 8.4, No. 341829.
1—1 hp., 115 volt, RPM. 1250, plus 5%, size E. type CCM, Amp. 8.4, No. 233334.
1—1 hp., 115 volt, RPM. 1250, plus 5%, size E. type CCM., 8.4 Amp. No. 233338.

All Crocker-Wheeler motors with Cutler-Hammer Starters.

VERTICAL MOTORS

In Good Condition

8—2¾ hp., 880 RPM., type S, 110 volts, Westinghouse with starters.
4—3 hp., 1040 RPM., 110 volts, Crocker-Wheeler with starters.
4—2.5 hp., 850 RPM., 110 volts, Crocker-Wheeler with starters.

These motors may be seen by applying to Engineering Dept.

Shipley Construction & Supply Co.
42nd St. and 2nd Avenue, Brooklyn, N. Y.

A. C. MOTORS

Large Stock—Reduced Prices. Immediate shipment. Send us your inquiries before you buy. We repair and rebuild all electrical machinery.

BERKSHIRE ELECTRIC COMPANY
Pittsfield, Mass.

FOR SALE

All in first class condition

GENERATOR

1—General Electric D.C. Type M.P. 110-115 Volt, 520 Amp. 805 r.p.m. with field Rheostat and Rails.

MOTORS

1—D.C. Watson 2½ Hp., 19 Amp., 110-115 Volts, 930 r.p.m. complete with starter and rails.
1—Crocker-Wheeler 5 Hp. D.C., 110-115 Volts, 960 r.p.m., 5 Hp., 38 Amp. Complete with starter and rails.

HUTTIG MANUFACTURING CO.
Muscatine, Iowa, U. S. A.

IMMEDIATE DELIVERY

60 CY. 3 PH. ENG. SETS, ETC.

2—150 Kva. 240-480 V., Engs. 14¼ x 18.
375 Kva. 2300 V., G.E. 25 x 24, 150 Rev. Eng.
300 Kva. 240-480 V., 40 Cy., 3 Ph., G.E. Cor. Eng.
1000 Kva. 2300-480 V., cross Comp. Cor. Allis.
150 Kva. 2300 V., cross Comp., 4 valve Chuse.
625 Kva. 2300-480 V., G. E. cross Comp.
750 Kva. NEW., 164 r.p.m., Gen. only.
175 Kva. 220 V., Westg. 17 x 15 engine.
937 Kva. 2300 V., 164 rpm., G.E. Lentz, C. Comp.
1000 Kva. 2300-480 V., 90 Rev. Gen. only.
NEW 475 Kva. OIL ENGINE SET, 600 V., 3 Ph., G. E.

3 PH. A. C. MOTORS, D. C., ETC.

NEW 750 hp., 180 r.p.m., 2200 V., mill type.
400 hp. 112 Rev., 2200 V., 25 Cy.
200 hp. 1800 Rev., 440 V., G. E.
150 hp. 850 Rev., 2300 V.
400 hp. Syn., 720 Rev., 2300 V.
400 hp. G. E., 2200 V., 720 Rev.
300 hp. 440 V., Allis, 600 Rev.
NEW 350 hp. 600 Rev., 3 bearing, 440 V.
2—700 Kva., 25 Cy., Syn. condensers.
NEW 468 hp., 187½ Rev., 2200 V., 25 Cy., Syn.
200 hp. 390 Rev., 500 V., Dir. Cur. G. E.
150 hp. 750 Rev., 230 V., G. E. Dir. Cur.
200 hp. 300 Rev., 115 V., Dir. Cur.
250 hp. 130 Rev., 250 V., Dir. Cur.
500 hp. 260 Rev., 500 V., Dir. Cur.

ROTARIES & M. G. SETS, ETC.

5—300 Kw. Ry. rotaries, 25 Cy., 3 Ph., 15,000 V. Trans.
400 Kw. Ry. rotary, 3 Ph., 60 Cy., 4000 V. Trans.
400 Kw. 275 V., 60 Cy., rotary, 4000 V., Trans.
1000 Kw. 250 V., M. G. set, 6600-4000 V. A.C.
640 Kw. 50 Cy., 3 Ph., A.C., 550 V., D.C.M.G.
NEW 10 and 15 Kw., 125 V., TURBO EXCITERS.
587 hp. RUST TYPE G. & W. BOILERS, 175 lb.
2—480 hp. B. & W. boilers. Det. Stokers, 175 lb.
1600 ft. Wheeler surface cond. and auxls.
4—300 hp. B. & W. boilers, 160 lb.
4—350 hp. Heine, 150 lb.
30—Air compressors steam and belt drive, steam vacuum and centrifugal pumps, rock crushing plants, gas engines, etc.

ROSS POWER EQUIPMENT CO.
Indianapolis, Ind.

FOR SALE

IMMEDIATE DELIVERY

Complete Power Plant

1500 kw. G. E. vertical type turbo-generator, 2300 volts, 60 cycle, 3 phase Sterling boilers, 175-lb. steam pressure and all auxiliaries.

All equipment in good operating condition.

WISCONSIN RAILWAY, LIGHT & POWER CO.
Winona, Minnesota.

MACHINERY WANTED MISCELLANEOUS

WANTED

ENGINE GENERATOR SETS

2—250 or 300 K.W. or larger generators, 250 volts, direct current, directly connected to simple engines (not compound), either 4 valve, piston valve or Unaflow type.

Give name of manufacturer, shop number, age, condition, floor space occupied, and all other information at hand.

Madison Coal Corporation
Purchasing Department,
907 S. Michigan Ave., Chicago, Ill.

WANTED

One 800 to 1000 kw., 3 phase, 60 cycle, 440 volt

GENERATOR
DIRECT CONNECTED TO CORLISS ENGINE

Must be simple and not compound.

AMERICAN MACHINERY CO.
518-524 4th Street, Oakland, California.

We Want to Buy

NEW OR SECOND HAND

1 Frequency Changer Set. Generator to deliver 5,000 kva., 2600 volts, 3 phase, 60 cycles, motor to be self-starting synchronous type and to be connected to a 2600 volt, 3 phase, 25 cycle, circuit.

Necessary transformers to transform an output of 5,000 kva., 60 cycle from 2600 volts to 34,000 volts.

Necessary switching, starting and other auxiliaries.

W735—Electrical World
10th Ave. at 36th St., New York City

"Opportunity" Advertising:

Think *"SEARCHLIGHT"* First!

0100

You can buy Electrical prices that will event

PRICES of electrical goods will not drop for some time. Manufacturers are stocked with reserves of high-priced raw materials and wage rates of labor are high. Prices of many raw materials used in the manufacture of electrical goods have taken a drop, but little of this low-priced material will find its way into the finished product for many months. It is obvious that manufacturers will not fabricate electrical goods of high-priced materials and place them on the market at a loss to themselves.

The demands of normal industry are not sufficient to require the full operation of increased facilities acquired during the war, resulting in an increased overhead unit cost that will offset any but a radical reduction in the present cost of labor.

Lower prices will eventually come. The War Department is meeting this anticipated reduction by offering you electrical goods at prices below existing market quotations and at figures which will obtain many months to come in the commercial field.

Look over the list of materials here at fixed prices and BUY NOW!

Watch for future War Department offerings in electrical goods.

NO. 20675

LIGHTNING ARRESTERS—150, Type W. B. Horn, 36,000 volts, single pole. Mfr. Railway Industrial Engr. Co., Pittsburgh, Pa. Fixed price, $23.00, 20 per cent off for lot.
Located at Columbus, Ohio.

NO. 17606

FIELD BUZZER-SERVICE—Model 1914, new. Fixed price, $8.00 ea. $12 for two. $5.00 ea. for 25, $4.00 ea. for lot.
Located at Chicago, Ill.

NO. 18111

INSULATORS — Pin Type, 35,000 volts, with 1⅜ in. pin hole, packed in cases. Fixed price, $.65 each.
Located in Kearny, N. J.

NO. 10247

RESERVE CELL BATTERIES No. O-4, excellent condition, 34,150 batteries. Mfr. National Carbon Co., Cleveland, O. Fixed price, $10.00 per C.
Located at New Cumberland, Pa.

NO. 17609

PERRIN CABLE—In circular loom, 5 pr. No. 19 B & S copper wire insulated with rubber covering 3/32 in., 82,250 ft. cable. Mfr. F. M. Perrin, Boston Mass. Fixed price, 8c per ft.
Located at Philadelphia, Pa.

NO. 20676

LIGHTNING ARRESTERS—150, Type W. B. Horn, 70,000 volts, single pole. Complete with 18 ft. resistance rods. Mfr. Railway Industrial Engr. Co., Greensburg, Pa. Fixed price, $50.00 ea., 20 per cent discount for lot.
Located at Columbus, Ohio.

Address Communications to Depot Quartermasters at These Addresses.

NEW YORK
461 Eighth Ave,
New York City

ATLANTA
Transportation Bldg.
Atlanta, Ga.

CHICAGO
1819 West 39th Street
Chicago, Ill.

SAN FRANCISCO
Fort Mason
San Francisco, Calif.

BOSTON
Army Supply Base
Boston, Mass.

SAN ANTONIO
San Antonio, Texas

Goods now at
ually come

The items listed here are also offered for sale by the War Department. Look them over carefully and write to the Depot Quartermaster nearest you for complete information. The list of Depot Quartermasters' addresses are given on preceding page.

Motors A.C. and D.C. from 1-50 hp.
Transformers, 3 phase from 5 to 300 kva.
Engine and Generator 72 kw.
Copper Bus Bar
Field Buzzers
High Tension Insulators
High Tension Fuse Holders
Controllers
Protector Blocks
Lightning Arresters
Soft Iron Wire
Relays
Sounders
Milometers
Generators
Lag Screw Insulators
Repeating Coils
Retarding Coils.

The War Department also has for sale a large quantity of various materials ranging from drafting room equipment, to the necessities of central stations and manufacturing plants of a wide range of industries.

SURPLUS PROPERTY BRANCH
Office of the Quartermaster General
WAR DEPARTMENT
MUNITIONS BUILDING, WASHINGTON, D. C.

Use This Coupon Today
Upon its receipt the War Department will send you a booklet covering the various materials and equipment they are offering for sale at fixed prices.

Chief, Sales Promotion Section,
Office of the Director of Sales,
Dept. A, Room 2515, Munitions Bldg.,
Washington, D. C.

Kindly send Bulletin on Materials and Equipment offered in M. & E. M. Fixed Price List No. 10 to:

Firm Name.....
Street Address.....
City..... State.....
Signed by.....

A Big Link In A Big Chain

A series of sales of colossal importance to American Industries is now in active progress; this particular "Link" is but one of a "Big Chain." This chain through its various links, alone affords the opportunity to deal in a steady market where price and quality meet and if anything, quality predominates.

The biggest of the big manufacturers, those with quality reputations to maintain, are buying from the War Department; that fact alone is the evidence of quality. These same firms doing business under the keenest of competition needs must buy "close," for in many cases their profits depend on narrow buying margins; they buy from the War Department, not alone their raw materials but finished products of general industrial and commercial use and they get them when they want them and as they want them.

The unquestionable merit of each and every offering coupled with practically pre-war prices, with every facility for inspection, bidding and speedy shipment pronounce the War Departments' Surplus Property Branch the Leading Market of today. Is your source of supply as steady, as reliable, as consistently reasonable in its prices and as convenient?

This sale will be conducted by negotiation through the various Depot Quartermasters.

Surplus Property Branch

Office of the Quartermaster General, War Department

Munitions Bldg., Washington, D. C.

S.P.D. NO. 14079

7—MOTORS, 3 hp. continuous 40 deg. C. 115 volt. D.C. shunt comm. 1150 r.p.m. con. speed floor mounted open type I frame 3 slide rails, with 10 in. x 5 in. pulley.
7—RHEOSTATS, starting. Industrial Controller Co.'s Class 1165.
Mfr.—Robbins & Myers, Phila., Pa.
Location—Pullman, Ill.

S.P.D. NO. 3143

37,501—BASE PLUGS.
8,470—Drawn, curled and centered.
28,181—Drawn, curled
850—Drawn 1st operation.
Condition—new.
Mfr.—Ritter Can & Specialty Co., Philadelphia, Pa.
Location—Philadelphia, Pa.

S.P.D. NO. 1222

200—SWITCHES, 6 pole.
Mfr.—The Century Tel. & Const. Co., Inc., Buffalo, N. Y.
Location—S. C. G. S. Depot, Philadelphia, Pa.

S.P.D. NO. 1699

60—SEARCHLIGHT CABLE REELS, KD
Location—Army Supply Base, Kearney, N. J.

S.P.D. NO. 2730

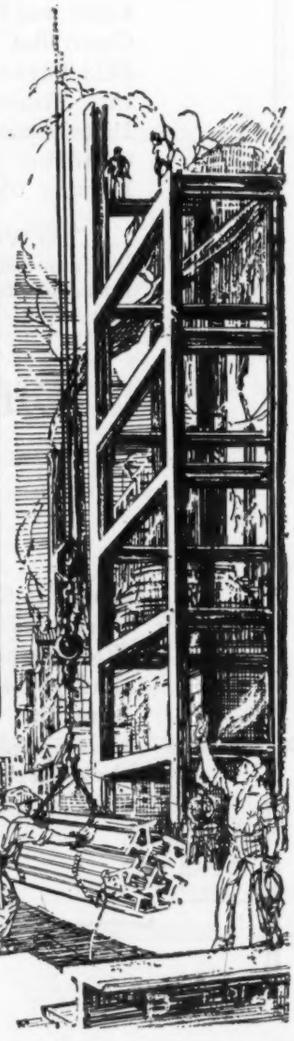
1—GALVANOMETER, 1200 Ohms resistance.
Mfr.—Standard Parts Co., Cleveland, Ohio.
Location—Factory.

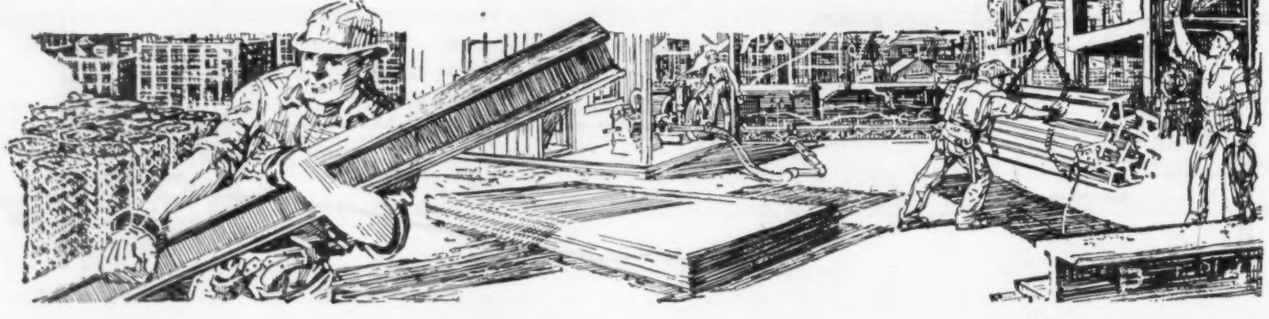
The following items, stored in various quantities, in various locations, are also for sale by negotiation; detailed information on these items may be had by sending the coupon below.

Switches
Searchlight Cable Reels
Galvanometer
Base Plugs
Parts for 15 hp. Motors
Lightning Arresters
Controllers and Parts
Cut-in-Stations
3 hp., 230 V. Starting Boxes
Panels, W. E. No. 143316 Spec.
Switchboards, 4-line mono.
Jack Wedges with Cord.
Tel. Switch Wedges
Buzzer Connectors
Starting Rheostats
Misc. Tel. Equip.
W. E. A. S. A. Signal Groups
Starting Rheostats
¾ in. Friction tape
Cords W. E. No. 348
Circuit Detectors
Nipples
8 in. Check Valves
Connectors, Brass
3 in. Galv. Steel Hose Clamps
3 in. Water Hose
Suction Sleeves, Galv.
½ in. Globe Valves, Brass
8 in. Flange Valves
Misc. Pipe Fittings
¾ in. Barrel Cocks
Brass Compression Cocks
Brass Stop Cocks
½ in. Compression Brass Finish Cocks
Foot Valves and Strainers
Cases for Wrist Watches
Kunkle Burner Oil Tanks
Misc. Lab. Equip.

Chief, Sales Promotion Section
Office of the Director of Sales,
Dept. L-11, Room 2515
Munitions Bldg., Washington, D. C.
Kindly send Bulletin on Materials and Equipment offered in M. & E. M. List No. 11 to:

Firm Name .....
Street Address .....
City ..... State .....
Signed by .....





ELECTRICAL WORLD

Think "SEARCHLIGHT" First

ADVERTISING RATES

POSITIONS VACANT—Business Opportunities and other undisplayed ads, 8 cents a word, minimum $2.00 an insertion.

POSITIONS WANTED—Evening work wanted, tutoring and other undisplayed ads of individuals looking for employment, 4 cents a word, minimum 75 cents, **payable in advance.**

ADD 5 WORDS for box number in undisplayed ads if replies are to any of our offices. There is no extra charge for forwarding replies.

DISCOUNT OF 10% if one payment is made in advance for 4 consecutive insertions of undisplayed ad.

ADS IN DISPLAY TYPE—Space is sold by the inch (30 in. to a page), the price depending upon total space used within a year, some space to be used each issue.

RATE PER INCH for ads in display space:

1 to 3 in., $5.00 an in. 15 to 29 in., $4.50 an in.
4 to 7 in., $4.80 an in. 30 to 49 in., $4.40 an in.
8 to 14 in., $4.60 an in. 50 to 99 in., $4.20 an in.

POSITIONS VACANT

EMPLOYMENT

POSITIONS WANTED

FOR SALE

Electrical Manufacturing Company

For Sale: Controlling interest in electrical manufacturing company incorporated for $10,000, all stock par value fully paid. Company manufactures weather proof sockets, rosettes, receptacles, cutouts, etc. Fully equipped plant for manufacturing all screw shells for sockets, fuse plug caps, shells, etc. Makes all its own metal parts, sells parts outside also. Company established two years, enjoys some of the best jobbing trade in the country; have plenty orders to run plant until February, 1921. Company sound and on paying basis. Reasons for selling: desire a change, purely personal. Will only consider selling to high caliber man with wide experience and ability in this line. I own 53 shares of capital stock; will sell my interest for $6,000, purchaser to assume duties of president and general manager on salary of $175 a month. Location Missouri town of 2,500 in Ozarks. Buyer to take active charge Jan. 1, 1921. Address, Wm. M. Nelson, Box 178, Mountain Grove, Mo.

Generators

General Electric, type A.T.B. alternating generators, 100-kw. and 75-kw., 600-v., 3-phase, 60-cycle, complete with base, pulley, excitors, and panel boards. Libby Electric Co., 100 Mechanic St., Worcester, Mass.

Generator

100 KW. generator, General Electric No. 198346, Form B, 400 amperes, 250 volts, 500 revolutions; 50 HP. General Electric DC motor, No. 356146, Form A, 186 amperes, 230 volts, 610 revolutions. N. Y. Utilization Co., 149 Remsen St., Brooklyn, N. Y.

Meters

20 prepayment G. E. 5 amp. meters for sale. Operating condition. Burlington Light & Power Co., Burlington, Vermont.

TESTERS WANTED

ELECTRICAL APPARATUS AND EQUIPMENT

ACCEPTANCE AND MAINTENANCE TESTS ON SUBSTATION MACHINERY, CIRCUIT BREAKERS, RELAYS, UNDERGROUND CABLES, AND OTHER EQUIPMENT OF A LARGE NEW YORK CITY ELECTRICAL PUBLIC UTILITY CORPORATION. PREVIOUS TRAINING OR EXPERIENCE DESIRABLE.

J. A. COOK
BOX 37, STATION D
NEW YORK CITY

In Replying to "Blind" Ads

be careful to put on envelope the key number in the ad and also local address of office to which reply is sent.

10th Ave. at 36th St., New York.
935 Real Estate Trust Bldg., Phila.
533 Leader-News Bldg., Cleveland.
1570 Old Colony Bldg., Chicago.
531 Rialto Bldg., San Francisco.

Important

Original letters of recommendation or other papers of value should not be enclosed to unknown correspondents — send copies.

0195

FOR SALE

Transformers

Three 500 kva. 13,200-2,300 volt, 60 cycle, oil-cooled, outdoor type G. E. transformers. New condition. Four primary taps; low price. Burlington Light & Power Co., Burlington, Vermont.

POSITIONS VACANT

A LARGE electrical manufacturing company has some positions open for technical graduates to train for inspection and testing work on automatic installations; men will be located in different parts of the United States. The work offers good opportunities for advancement; state age, education, experience and present salary. P-748, Elec World, Old Colony Bldg., Chicago.

AN EXPERIENCED stock accountant wanted, $150 per month for right man. Virginia-Western Power Co., Clifton Forge, Virginia.

CARBON brushes, technical man wanted who can manufacture carbon brushes and other goods for electrical purposes. Answer stating age, past positions, and salary expected to start. P-720, Elec. World.

CHEMIST wanted by a long-established insulated wire company. Must be familiar with analysis of rubber wire compounds and testing cotton yarns. P-744, Elec. World.

POWER PLANT DESIGNER

Familiar with Steam Station Design by Eastern Public Utility Corp. State qualifications, age, and salary expected in first letter.

P751—Electrical World
Real Estate Trust Bldg., Philadelphia

POSITIONS VACANT

CHIEF draftsman wanted to take entire charge of drafting department with established firm manufacturing transformers, small and medium sized AC and DC motors and generators. None but experienced men need apply. State training and experience, age, salary expected and when available. P-733, Elec. World.

COMMERCIAL department of an electrical utility company offers an excellent opportunity to young man with some previous commercial experience in electric light and power work. Location—Eastern Ohio. In reply state full particulars, previous experience and salary desired. P-728, Elec. World, Leader News Bldg., Cleveland.

ELECTRICAL engineering graduate wanted of 1918 or 1919 for sales work. The Electric Controller & Mfg. Co., Cleveland, Ohio.

EXPERIENCED operators for large generating station, on Eastern Seaboard, preferably with some technical training. State age, education, and experience. Salary $125 to $150. P-738, Elec. World, Real Estate Trust Bldg., Phila.

LARGE manufacturer of electrical apparatus requires a few more young technical graduates for test floor work. A real opportunity is offered for a varied experience at good wages. P-297, Elec. World, Leader-News Bldg., Cleveland.

MATHEMATICIAN and computer wanted: physicist preferred. Address by letter only. W. H. Meadowcroft, Orange, N. J.

METER tester wanted for testing; meters at a central station of about six thousand meters located in New England; good opportunity for the right man; state age, experience, and salary expected. P-697, Elec. World.

SWITCHBOARD wireman thoroughly experienced on instrument and control wiring for large steam power station; location, Ohio; state in first letter your age, education, experience, salary expected and when you could be relieved from present position. P-749, Elec. World, Leader News Bldg., Cleveland.

EXECUTIVES

seeking superior positions find our confidential service extremely satisfactory. Let our Mr. H. H. Harrison confidentially negotiate for you suitable positions with proper employers, as he has successfully done for thousands of others since 1909. Inquiries invited.

THE NATIONAL BUSINESS BOURSE
Confidential Negotiators
Association Building—Chicago

EMPLOYMENT SERVICE

EXECUTIVES qualified for salaries of $2,500 to $25,000 and upwards, are invited to communicate in strict confidence with the undersigned, who will conduct preliminary negotiations for such positions. The procedure used is peculiar to this service, differing essentially from all others; and is constructive and initiative; applied individually; and in no way jeopardizing present connections. Established 1910. Send name and address only for particulars. R. W. Bixby, Inc., 310 Lockwood Building, Buffalo, New York.

POSITIONS WANTED

ARMATURE winder, familiar with a.c. and d.c. windings, coil making, lathe and machine shop work. Address, A 2, Box 463, Welch, W. Va.

AUDITOR, wide experience as general auditor, secretary and treasurer of utility companies; moderate salary; best references. PW-632, Elec. World.

BUSINESS executive—Experience: general manager, sales manager, designing and production engineer. Last connection, liabilities three times capital. Business systematized, surplus accumulated then sold for five times capital. Graduate 1911. PW-683, Elec. World.

ELECTRICAL engineer, having general knowledge of supervision of an electrical corporation in the office, field and plant, desires position; nine years' practical experience. PW-694, Elec. World.

ELECTRICAL engineer with long experience in practical shop work, in laboratory and office, desires position. Has model ready for new device to connect to lamp socket. Necessary tools can be made in few weeks. PW-731, Elec. World.

POSITIONS WANTED

ELECTRICAL and mechanical engineer—technical graduate; G. E. test; wide experience in power plant management, machine design, and arc welding applications; practical electrician and welder, proven executive ability; desires change. Minimum salary $3,200. Metropolitan District preferred. PW-725, Elec. World.

ELECTRICIAI wants maintenance work; familiar alternating direct motors control, etc.; seven years in charge. PW-745, Elec. World.

ELECTRICAL engineer desies position as superintendent for electrical contractor, engineer or industrial plant; capable of estimating, superintending and laying out of details for both lighting and power; 30 years' experience, installing motors, generators and transformers. PW-753, Elec. World.

ELECTRICIAN, correspondence school technical education, army school instructor, experienced wireman, lineman, telephony and radio. Age 30, single. PW-750, Elec. World, Leader-News Bldg, Cleveland.

ELECTRICIAN and meterman with over eigth years' experience on all types of meters and four years on power house maintenance. PW-702, Elec. World, Real Estate Trust Bldg., Phila.

ESTIMATOR and superintendent of construction work, nineteen years' experience in all branches of the electrical line, business getter and general manager. PW-754, Elec. World.

GENERAL manager of wide experience, technical and business training, wants change to greater opportunity. If your property is no wprosperous I can maintain it so. If it is run down, or "in bad" publically, I can pull it out. Age 39 years. 20 years' experience, and accustomed to full responsibility. Three years in present position as district manager. Will consider either straight salary or percentage of gain proposition. PW-673, Elec. World, Old Colony Bldg., Chicago.

POSITIONS WANTED

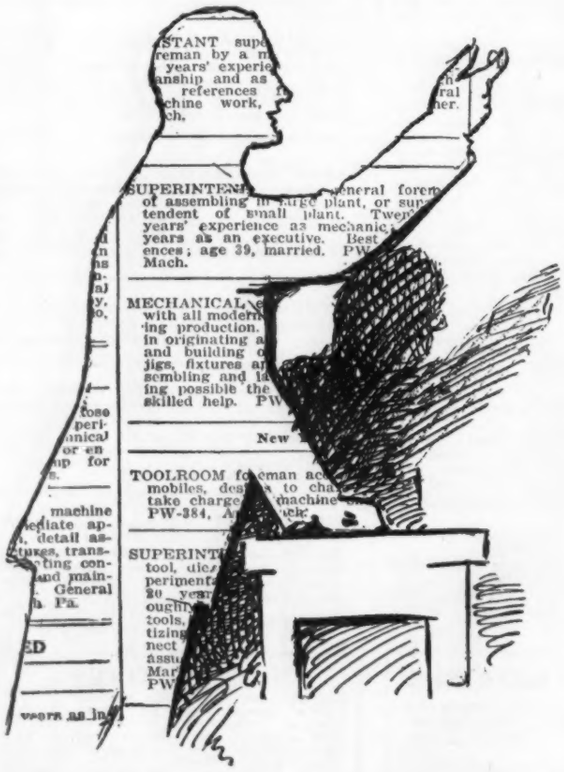
POSITION along maintenance, testing or inspection by young man, age 29, married, foreign born, I. C. S. graduate, good technical knowledge of electrical apparatus; eight years' practical experience maintenance, two years G. E. test of E. R. equipment; substation and switchboard operating; A 1 reference; salary $140, anywhere; available Jan. 15. PW-746, Elec. World.

PUBLIC utility manager, electrical engineer, age 38, married; 18 years' experience, covering design, construction, opeation and management of electric properties; member A. I. E. E., ex-officer Engineers, U. S. Army, desires position at once. PW-713, Elec. World, Old Colony Bldg., Chicago.

SUPERINTENDENT or assistant superintendent of medium size or small central station property, hydro-electric preferred but not necessary; experience in practically all departments; age 30, single, hard worker, technical education; now assistant superintendent of 1,200 kw. system; can give satisfactory references; available upon short notice. PW-718, Elec. World.

SUPERINTENDENT; graduate electrical engineer, age 27, married, desires position with factory, mill, etc., as electrical superintendent; have had engineering and maintenance experience and possess executive ability. Address A. B. J., 819 Hamilton Ter., Baltimore, Md.

TECHNICAL engineering graduate, age 24, desires position; experienced in design and estimating of wiring and illumination heating and ventilation, piping and general industrial plant equipment layouts; location immaterial. P W-752, Elec. World, Old Colony Bldg., Chicago.



"SEARCHLIGHT" Want ads Talk—

They go direct to those in the industry you wish to reach and tell your story in a forceful and business-like way.

They don't mince words but get right to the point.

Use them for—

Agencies Wanted	Industrial Sites
Agents Wanted	Labor Bureaus
Auction Notices	Machine Shops
Bids Wanted	New Industries Wanted
Books and Periodicals	Partners Wanted
Buildings For Sale	Patent Attorneys
Business Opportunities	Patents For Sale
Civil Service Opportunities	Plants For Sale
Contracts to be Let	Positions Vacant
Contracts Wanted	Positions Wanted
Desk Room For Rent	Proposals
Desk Room Wanted	Property For Sale
Educational	Receivers' Sales
Employment Agencies	Representatives Wanted
Foreign Business	Salesmen Wanted
For Exchange	Specialties
For Rent	Sub-Contracts Wanted
Franchises	Water Front Property
Help Wanted	Work Wanted

Miscellaneous for Sale, for Rent or Want Ads

For Every Business Want "Think SEARCHLIGHT *First"*

0144

An Auction Sale of Intense Interest

Niagara Electro Chemical Company

Head Office, 709-717 Sixth Avenue, New York, N. Y.

BOYNTON BROTHERS & CO., *Auctioneers*

37 Smith Street, Perth Amboy, N. J.

Will sell at PUBLIC AUCTION

Wednesday, December 29th, 1920

at 11 o'clock in the forenoon, to the Highest Bidder

ITS FACTORY BUILDING AND EQUIPMENT LOCATED ON RECTOR ST. NEAR FAYETTE ST., PERTH AMBOY, N. J.

All Equipment in First Class Condition

Electrical Division

GROUP NO. 1

1—Westinghouse Rotary Converter, 1000 kw., 6 phase, 60 cycle, 600 volts D.C., 900 r.p.m. Shunt wound, Interpole, Self Strating from A.C. side.
4—Transformers for same, 385 kva. each, Single Phase, 60 cycle, 13200 volts, 425 volts, O. I. S. C.
1—Starting Panel with necessary switches.
1—D.C. Machine Panel with necessary switches, meters and relays.
1—3 Phase High Tension Oil Switch, and 6 High Tension Disconnecting Switches.

GROUP NO. 2

3—General Electric Rotary Converters, Booster Type with commutating field, 3 phase, 60 cycle, 8675 amps., 270-320 volts, 300 r.p.m. Shunt Wound, Self Starting from A.C. side.
3—Transformers, 2700 kva., 3 phase, 60 cycles, 13200/222/111 volts, oil insulated, water cooled.
3—Starting Panels with necessary switches.
3—D.C. Machine Panels with necessary switches, meters and relays.
1—Steel Transformer car.

GROUP NO. 3

Switchboard and meters for main Station control.
11—Slate panels, various sizes.
Circuit breakers, switches, meters and relays.

GROUP NO. 4

6—Moloney Transformers, Type HE; 3—25 kva., 60 cycle, single phase, 13200/450 volts, oil insulated, self-cooled, and 3—20 kva., 60 cycle, single phase, 13200/220/110 volts, oil insulated, self cooled.
2—3 Phase oil switches, 13200 volt, 300 amp.

GROUP NO. 5

1—Westinghouse Generator Set: Generator—commutating pole, 15 kw., 150 volt, 100 amp., 1740 r.p.m., direct connected to type C. S. Motor, 22½ hp., 440 volts, 3 phase, 60 cycle with compensator. Set mounted on cast iron base.

GROUP NO. 6

1—Jantz & Leist Plating Generator, 6 volt, 600 amp., 850 r.p.m., direct connected to Westinghouse Type CS Motor, 440 volt, 60 cycle, 3 phase, 5 hp. Set mounted on cast iron base.
1—3 kw. Motor Exciter set for above.

GROUP NO. 7

Electric Motors

6—Westinghouse CS, 10 hp., 440 volts, 60 cycle, 3 phase, 860 r.p.m.
1—Crocker Wheeler 7½ hp., 440 volts, 60 cycle, 3 phase, 1180 r.p.m.
2—Westinghouse CS 5 hp., 440 volts, 60 cycle, 3 phase, 860 r.p.m.
1—Crocker Wheeler 3 hp., 440 volts, 60 cycle, 3 phase, 1130 r.p.m.
1—Westinghouse CS, 2 hp., 440 volts, 60 cycle, 3 phase, 860 r.p.m.
1—Westinghouse CA, 1 hp., 110 volts, 60 cycle, 1 phase, 1140 r.p.m.
3—Wagner ½ hp., 110 volts, 60 cycle, 1 phase, 1140 r.p.m.
2—Westinghouse CA, ¼ hp., 110 volts, 60 cycle, 1 phase, 1200 r.p.m.

GROUP NO. 8

Slip Ring Motors

9—Westinghouse CI, 3 hp., 440 volts, 60 cycle, 3 phase, 1100 r.p.m.
4—Westinghouse CI, 1½ hp., 440 volts, 60 cycle, 3 phase, 1100 r.p.m.

Also Cranes, Hoists, Tanks, Sheet Metal Working Machines, Time Clock, Etc.

List of Equipment, Terms of Sale and Inspection Permits Furnished on Application at Either of Above Addresses

Niagara Electro Chemical Co., by Hector R. Carveth, General Manager
Auctioneers, Boynton Brothers & Co., by Clancy C. Boynton, President

FOUNDRY FOR SALE, PONTIAC, MICH.

within twenty-five miles of Detroit, on good concrete road, good rail facilities. Fully equipped for aluminum, brass and bronze casting work and could readily be converted to grey iron. Fifteen thousand square feet of floor space. One-story concrete block construction built about two years ago. Four acres of land. Plant is centrally located and labor conditions are good. Will sell with or without equipment. For particulars and price, write:

DRAWER 47, SYRACUSE, N. Y.

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Manufacturers desiring representation or business connection, are invited to correspond with

W. G. WATSON & CO., LTD.
279 Clarence St., Sydney
Electrical Engineers and Merchants
Cable Code and Add., "Switchon, Sydney."
Western Union Code

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2003

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THEORETICAL and practical electrician and armature winder, familiar with a.c. and d.c. windings, voltage, speed, frequency, and phase changes; am married, 25 years of age, and capable of taking charge of shop. Address, A 1, Box 463, Welch, W. Va.

TWO recent college graduates, electrical engineers, desire positions with reliable engineering concern with good opportunity for advancement; location, Boston, Mass., or vicinity. PW-712, Elec. World.

YOUNG man, age 18, desires work with central station or electrical manufacturing company; transformer work preferred; location immaterial. PW-755, Elec. World, Old Colony Bldg., Chicago.

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Graduates for Sales Work Wanted

Electrical or mechanical university graduates wanted for sales work with a well established electrical manufacturer in the Middle West; correspondence confidential. Give full particulars. AS-668, Elec. World, Old Colony Bldg., Chicago.

Traveling Salesman Wanted

Who can intelligently handle steam and electrical apparatus; thoroughly practical and experienced man required; mechanical engineer preferred. Write fully, stating age, past experience and salary expected. Greensboro Supply Co., Established 1898, Greensboro, N. C.

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Will Buy or Manufacture Article of Merit

Wanted—By a New Jersey manufacturing concern, manufacturing electrical machinery and who are anxious to take on an additional line, some patented article of merit. Will buy outright or manufacture on a royalty basis. BO-726, Elec. World.

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INSTRUMENT and meter specialists wanted everywhere. Demand exceeds supply. Our course in elctrical meter engineering qualifies you for responsible position. Our graduates are our best recommendations. Employment service free. Write for special offer. Fort Wayne Correspondence School, Fort Wayne, Ind.

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MUNICIPAL OWNERSHIP—If threatened with municipal ownership or other competition, secure expert advice. Dozens of successful campaigns. M-742, Elec. World, Old Colony Bldg., Chicago.

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Packard Transformers

Solve Your Problems in Efficient Way for

Power Circuits
Electric Furnaces
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Metering Types
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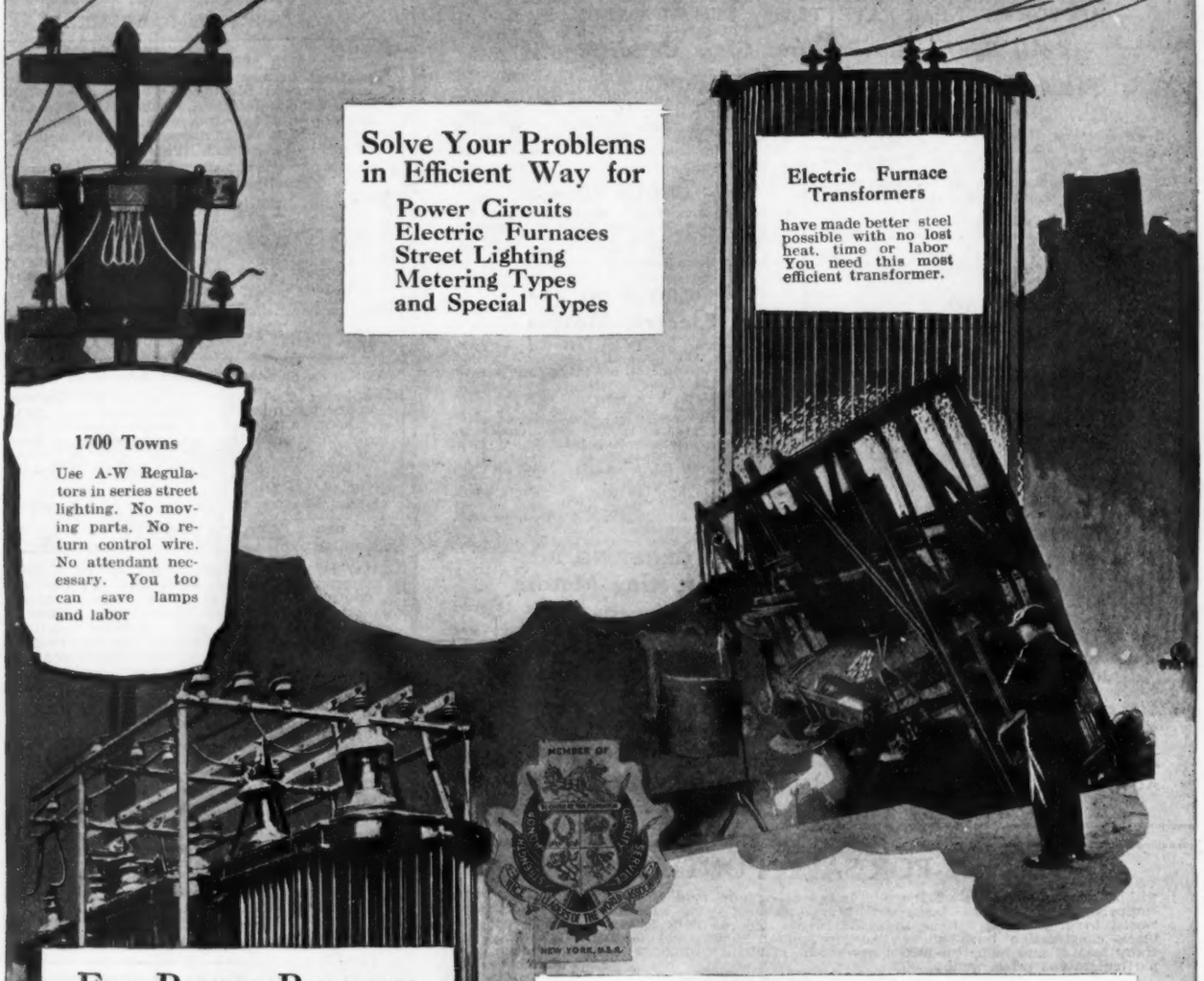
Electric Furnace Transformers

have made better steel possible with no lost heat, time or labor. You need this most efficient transformer.

1700 Towns

Use A-W Regulators in series street lighting. No moving parts. No return control wire. No attendant necessary. You too can save lamps and labor



For Power Purposes

You will be interested in the high efficiency—low temperature—high insulation and rugged bracing of these units which are built by transformer specialists. We build all types any size.

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R. and I. E. Switches

employ Faradoid Insulators as standard equipment for all voltages up to and including 66,000.

All iron and steel parts are hot dipped galvanized in accordance with N.E.L.A. standard specifications—typical of the many features that have made R. and I.E. Switches the strongest, most rugged, most dependable switches on the market.

A strictly quality switch in every particular.

What are your requirements?

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TRANSMISSION SWITCHING AND PROTECTIVE — EQUIPMENT —

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45,000 volts

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always make the "old man" swear.

'Guess he'll have to take the bull by the horns and standardize with Victors.

They're depreciation-proof because vitrification is complete and only the highest grade materials are used in their manufacture.

Victors defy depreciation and scorn abnormal load, temperature changes and moisture.

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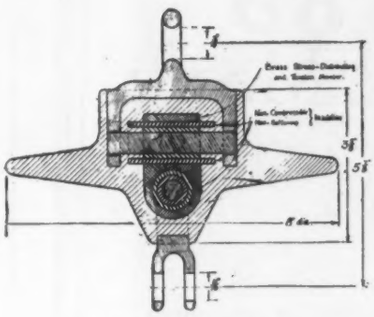
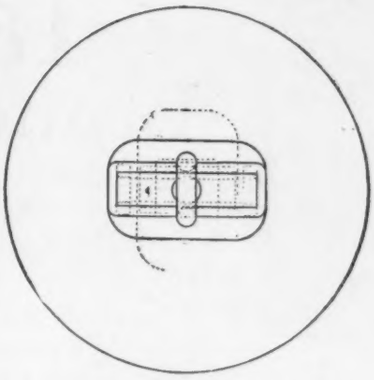
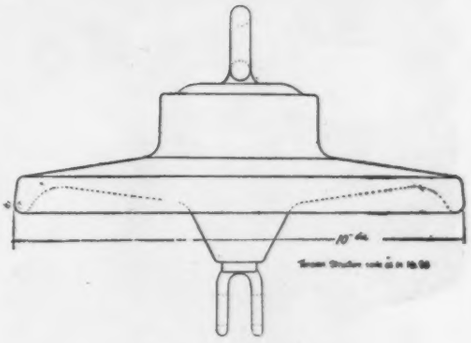
Points the Way to Better Insulation—



Disk Strain and Suspension Insulator No. 94.



Plain View of No. 94.



Disk Strain and Suspension Insulator No. 1504.

Insulator Characteristics That Mean *Longer Life and Better Service*

Physical Features

No motion play in the tension members—cannot pull together or apart.

Non-compressible and non-softening insulation interposed between tension members.

Enveloping insulation mass symmetrically disposed in relation to tension members.

Light in weight.

Electrical Characteristics

Capacity stress distributed over wide area.

Five interval insulation breakdown areas.

Equivalent to two insulators in series.

Ample Mechanical Strength.

Made of *"Paramold"* which means *high mechanical strength, high dielectric strength and high heat resistance.*

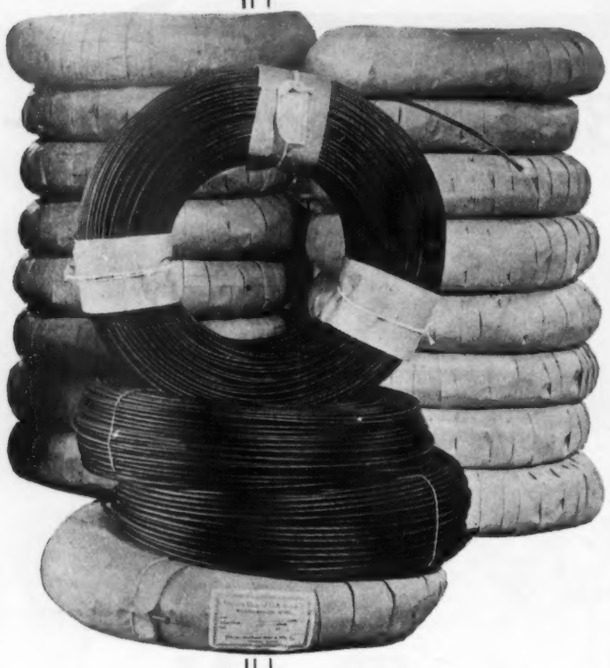
We also do Custom Molding.

Send for Blue Prints and Prices

HOPEWELL INSULATION & MANUFACTURING CO.

INCORPORATED

HOPEWELL, VIRGINIA



Weatherproof Wires *and the* 1885 Brand Mark

Since 1885 we have been specialists in the manufacture of high grade bare and insulated wires and cables.

A photograph of our Weatherproof Wire is shown on this page. This wire is put up on reels, or in coils, carefully wrapped, and shipped in cases of uniform weight.

When in the market for high grade Weatherproof Wire let the 1885 Trade Mark be your guide to maximum quality.

Chicago Insulated Wire & Manufacturing Co.
Sycamore, Illinois

Write for prices

Our products include Bare and Weatherproof Copper and Iron Wires, Slow Burning Weatherproof Wires, Signal Wires, Annunciator and Office Wires, Magnet Wires. Write for prices on the materials in which you are interested.

1885
ELECTRICAL WIRES & CABLES
1885

Manufacturers of Bare and Insulated Wires and Cables since **1885**

Where moisture is excessive—

Where acid or alkali water destroys ordinary insulated wire—

Where lead cables cannot be used because of electrolysis or wherever a heavy rugged type of cable is needed.

That is the place to use HAZARD Spiralweave Cables.

The cover is an extra heavy and tough *weave*. There are several types for different purposes.

Spiralweave Portable Cord
Spiralweave Mine Shaft and Borehole Cable
Spiralweave Mine Power Cable
Spiralweave Aerial Cable for Fire Alarm systems or other exacting purposes.

All have the inbuilt merit and dependability which are characteristic of all HAZARD products.

If you will outline your service conditions—voltage, present construction and kind of work—we shall recommend the best type to fit the task.

Booklet on request. *Quality Survives.*

HAZARD MANUFACTURING CO.

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Wilkes-Barre, Pa.

Makers of Quality Wire Rope Since 1848.

Hazard **Spiral-Weave Cables**

How Habirshaw cooperates in every field of electrical industry

HABIRSHAW'S cooperative policies have a definite meaning for everyone connected with the electrical industry. Take as an example Habirshaw distribution through the Western Electric Company.

Through the efficient, nation-wide warehousing of this well-known organization, Habirshaw wire is brought to every active market of the United States. It may be purchased in large or small quantities for immediate deliveries with the certain knowledge that a stock is always on hand. The Western Electric Service further offers Habirshaw buyers a great saving of time and money, to say nothing of inconvenience due to scattered buying, by enabling them to place entire equipment needs on the same order.

Complete factory stocks are always carried at strategic points so that local supplies are not dependent upon direct shipments.

Volume production, in turn, enables Habirshaw to maintain its standards and service at the market figure. *Consistent national advertising* is constantly establishing public confidence in the technicians of the industry and good will for Habirshaw.

Habirshaw's field service, comprising a highly trained corps of experts, is constantly in touch with actual service conditions to meet specific transmission requirements.

Technical cooperation is provided by Habirshaw's engineering service, and is available at all times for consultation on any problem of unusual difficulty.

Habirshaw Wire Manufactured by
Habirshaw Electric Cable Co.
Incorporated
Yonkers, New York

Habirshaw Wire Distributed by
Western Electric Company
Incorporated
Offices in All Principal Cities

HABIRSHAW

"Proven by the test of time"

Insulated Wire & Cable

The Symbol of Efficiency — Rome-Wire — *in Electrical Conductors*

ROME

is a good name to remember when contracting for

Wires and Cables for 1921

Increased Facilities

To meet the steadily increasing demands for Rome Wire and Cables we have materially enlarged the facilities and equipment in both our Rome, N. Y. and Buffalo, N. Y. plants. Therefore you may now expect your jobber to make prompt deliveries of Rome products.

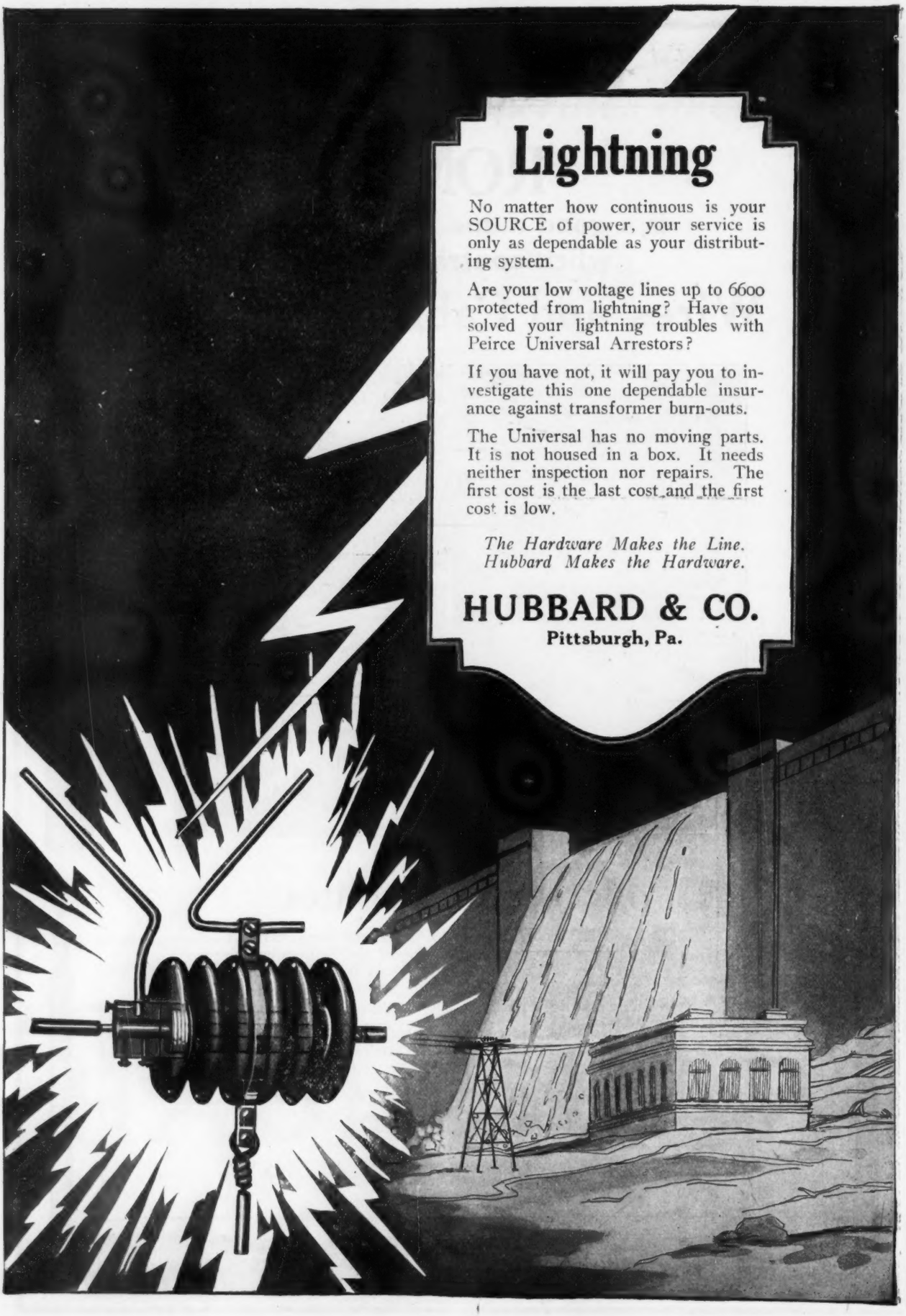
The high standard of excellence which has characterized all Rome Wire Products and Rome Service will be maintained.

Did you get your copy of Catalog No. 19?

ROME WIRE CO.

Rome, N. Y.

Diamond Branch Buffalo, N. Y.


Lightning
No matter how continuous is your SOURCE of power, your service is only as dependable as your distributing system.
Are your low voltage lines up to 6600 protected from lightning? Have you solved your lightning troubles with Peirce Universal Arrestors?
If you have not, it will pay you to investigate this one dependable insurance against transformer burn-outs.
The Universal has no moving parts. It is not housed in a box. It needs neither inspection nor repairs. The first cost is the last cost and the first cost is low.
The Hardware Makes the Line.
Hubbard Makes the Hardware.
HUBBARD & CO.
Pittsburgh, Pa.

Ready!

The Metal Molding Hand-Book

"For the Man on the Job"

Every contractor and wireman in the business needs this new Hand-Book—the most complete book ever issued on the subject of metal raceways for surface wiring. It gives full instructions—with many illustrations—for using National Metal Molding under all conditions. It also lists the various fittings and devices that are used in connection with Metal Molding. Because of its convenient size, the book can be easily carried and used right on the job. We will be glad to send you a copy, without charge. Write, or use the coupon below.

Fill in, tear out and mail this coupon

National Metal Molding Co.
1110 Fulton Bldg., Pittsburgh, Pa.

Please send me a copy of your new Metal Molding Hand-Book "For the Man on the Job."

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Ferrule type fuse with Economy "Drop Out" Renewal Link

ECONOMY *renewable* FUSES

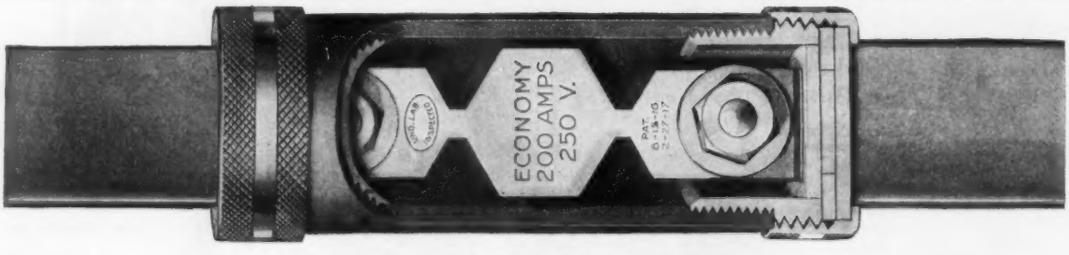
Industries persisting in the use of "one-time" fuses pay more for electrical protection than those equipped with Economy Fuses.

The famous Economy "Drop Out" Renewal Link makes possible an annual saving of 80% in fuse maintenance costs.

Nothing is destroyed when an Economy Fuse blows but the inexpensive strip of fusible metal. This is quickly and easily replaced with a new "Drop Out" Link without delay to men or machinery. The heavy cartridge, end caps and the winged washers which lock the fuse are virtually indestructible and are used again and again.

Check up fuse costs in your plant. And remember that Economy Fuses give maximum protection at minimum cost.

For sale by all leading electrical jobbers and dealers



Knife-blade Type, Economy Fuse

Economy Fuses were the first line using inexpensive bare links for restoring blown fuses to their original efficiency to be APPROVED IN ALL CAPACITIES by the Underwriters' Laboratories.

Economy Fuse & Mfg. Co., Chicago, U. S. A.

Economy Fuses are also made in Canada at Montreal

UNION
RENEWABLE FUSES

Many Fuse Users Waste Money

Thousands of concerns are using renewable fuses where the non-renewable type should be used, and vice versa. In this way hundreds of dollars are wasted yearly in plants all over the country. It was to help our customers correct this bad condition that we installed a service department, and a large number of concerns by availing themselves of this service have eliminated the large and needless waste of money caused by using the wrong type of fuse at various points on their circuits.

How to Eliminate this Waste

Without the slightest obligation on your part, one of our Fuse Engineers will make a careful survey of your plant and point out where you are using high-priced renewable fuses on circuits where blowouts will rarely if ever occur, and tell you where money is being wasted by using non-renewable fuses on lines subject to frequent blowouts.

Perhaps you will never know how much money is wasted on fuses in your plant until our Fuse Engineer calls—and this service costs you nothing.

In order to clear up any possible misunderstanding on the part of the public, we wish to announce that our Union Enclosed Fuses, both renewable and non-renewable, are fully approved by the Underwriters Laboratories, Inc. in all capacities of N.E.C. standard dimensions for both 250 and 600 volt service.

"UNION" renewable and non-renewable fuses are made in all capacities 0-600 Amp. 250 and 600 volt and are sold by all leading Electrical Jobbers and Dealers.

BY INVITATION MEMBER OF

Chicago Fuse Mfg. Co.

Oldest and largest manufacturers of Fuses, Electrical Protecting Materials and Conduit Fittings

Chicago, New York

UNION

—and also in SOCKETS the Hubbell Line is STANDARD: the design, material, and construction again express QUALITY

HUBBELL invented the Pull Socket to supply a pressing need. It was discovered that the ordinary Key Socket, hung high enough for proper illumination, was out of reach of short people.

Hubbell, by providing a socket with chain long enough to drop below the bulb, permitted the lamp to be raised several inches.

Its adoption was very rapid. People recognized the convenience of this type of socket, and were delighted with its perfect operation. The electrical industry found that the Hubbell mechanism was fundamentally right and have been able to offer no radical changes or improvements in it, for like all Hubbell Electrical Specialties the Pull Socket had been thoroughly planned and tested before it was introduced.

Hubbell Pull, Key and Keyless sockets are of standard "QUICKCATCH" design, and are provided with Edison screw base with a phosphor bronze spring contact, which prevents the bulb or plug working loose. The large easily wired contact screws will not drop out.

To specify Hubbell is to insure satisfaction—in Sockets as well as in the famous T-T Slot Receptacles.

Pull Socket No. 36[illegible]8

Look for the Globe on the Key

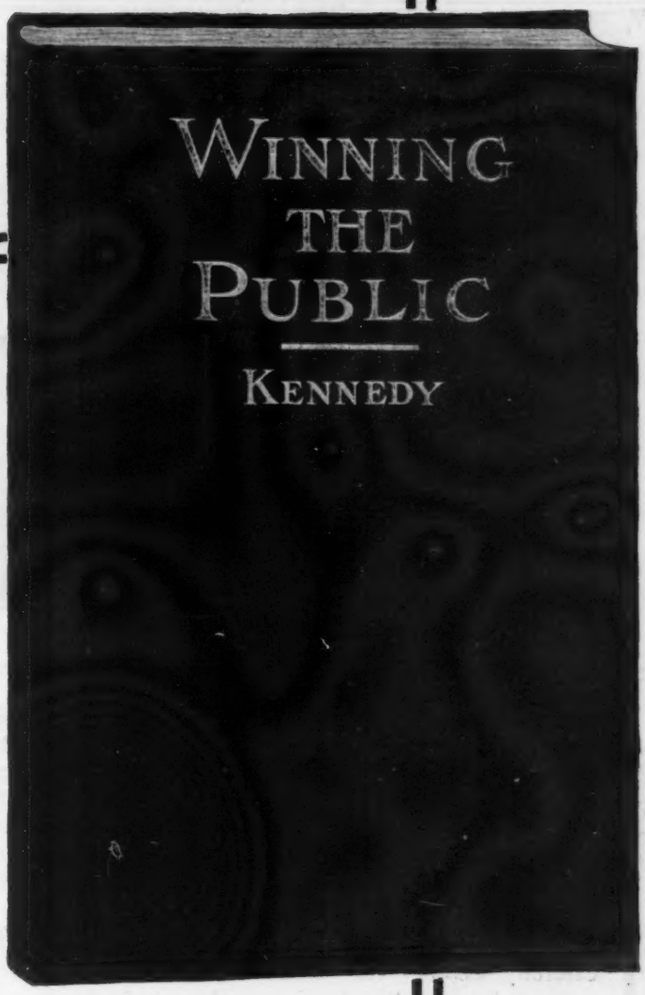
Key Socket No. 3664

Keyless Socket No. 3667
Look for the Acorn

HARVEY HUBBELL INC
ELECTRICAL SPECIALTIES
BRIDGEPORT CONN. U.S.A.

HUBBELL
REG. U.S. PAT. OFF.

An inspirational book for the entire electrical industry—



For the central station corporation, for any public utility, for executives of such companies, for their employees, for the entire electrical industry—the key to success is *service*. Service of the right kind means expansion for the industry, bigger business for the power company, more pay and promotion for the employee of such a company. Mr. Kennedy in this new book has written the first text book of service. He shows how to serve effectively. He proves that service brings success to the individual and to the corporation.

WINNING THE PUBLIC

By S. M. Kennedy

Vice-President in charge of Public Relations and Business Development, Southern California Edison Company

168 pages, 6x9, illustrated, $2.50 net, postpaid

Mr. Kennedy is a public service official of wide experience. He tells in his book how his own company and other successful public utility companies win the public through service. He gives central station executives useful hints on business development. He presents practical ideals for the consideration of department heads. He offers to public utility employees promotion-winning information. His book should be in the hands of every public utility official and employee, for it points the way to a broader field for the electrical industry and a greater success for all connected with the industry.

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You may send me on 10 days' approval **Kennedy's Winning The Public, $2.50 net, postpaid.** I agree to pay for the book or return it postpaid within 10 days of receipt.

Regular Subscriber to the Electrical World?.....

Member of A. I. E. E.?.....

Signed .....

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Photographs that Sell the Technical product

The McGRAW-HILL FIELD PHOTO SERVICE Department was organized some years ago in response to a widely felt need of furnishing a service through which advertisers could readily and economically secure striking installation pictures of their machines and apparatus in actual use. Approximately 700 McGRAW-HILL photographic representatives, locally distributed in all parts of the country, are now engaged in this work.

THESE photographers are carefully chosen for their prompt dependability in getting the picture they are asked to get—for their judgment shown in "taking" subjects to best advantage from an advertising standpoint—for their skill displayed in making photographs that reproduce effectively, and for their ability to get the news story while taking the picture.

This latter qualification is extremely important. Every effort is made to obtain the actual story of the machine on the job, and to assist in this we supply our photographers with carefully devised questionnaires to be filled out. The Field Photo Service Department always aims not only to get the picture but to get the story, and we make it a practice not to accept photographs from our photographers unless they are accompanied by the data.

THE advantages of this branch of McGRAW-HILL service to technical advertisers are obvious. Upon receipt of a list of installations we arrange all the interviews and secure the pictures. You are relieved of all worry and trouble and get your pictures and the story at minimum expense, besides having the satisfaction of putting the work into the hands of specialists on technical subjects.

MANY advertisers not only employ our Field Photo Service to secure definite lists of photographs, but give us a roving commission to take pictures of their machines wherever encountered.

IN connection with this department of McGRAW-HILL service we maintain a constantly growing library of stock negatives in the technical field. It contains at the present time about 3,000 photos, all of which are classified by subjects. Prints are promptly supplied at a moderate charge.

This Library of Technical Photographs is of special value to Advertising Agencies, a number of which frequently call upon its resources.

THE facilities of our organization for obtaining photographs of technical subjects are at the service of all who require such photographs. Primarily, however, it is an important link in the complete chain of McGRAW-HILL service to the technical advertiser. We not only write the proper copy for our advertisers, but we go out into the field for them and obtain pictures and stories which they are not in a position to get for themselves.

WE will gladly furnish detailed information regarding the cost and answer any questions.

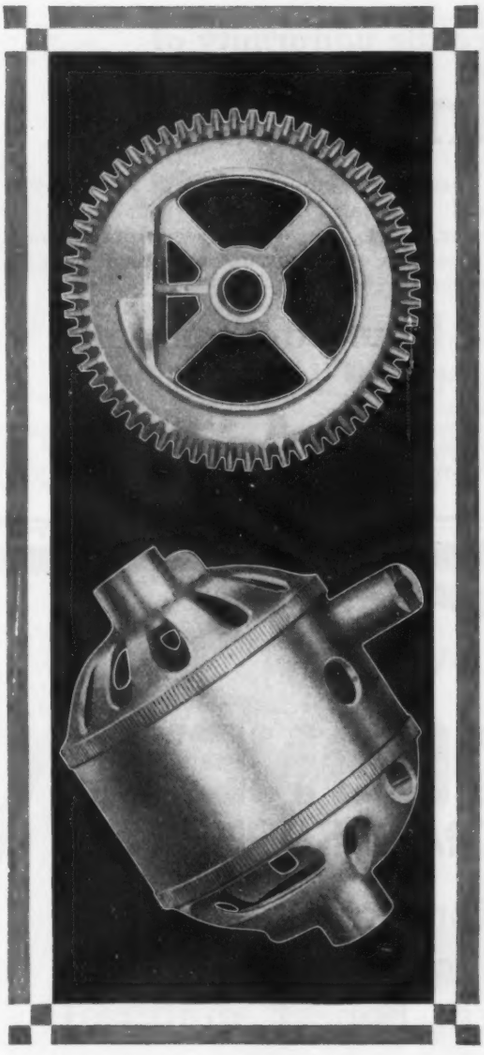
McGraw-Hill Company, Inc.
Tenth Avenue, at 36th Street
New York City

Power Coal Age
American Machinist Electrical Merchandising
Electrical World Engineering and Mining Journal
Journal of Electricity Engineering News-Record
Ingenieria Internacional Electric Railway Journal
Chemical and Metallurgical Engineering

McGraw-Hill Field Photo Service

We photograph your product on the job anywhere, and get the story of its service Available photos also supplied from stock — Specialists on technical subjects

Die-Molded Castings For Small Electrical Appliances



Stewart

The Stewart process of making die-molded castings makes available castings that are impossible to sand cast. Where absolute accuracy to the one-thousandth of an inch and constant uniformity must be maintained, the Stewart process enables us to guarantee perfect results.

The Casting That Comes From the Mold Is Finished— Needs No Machining

The illustration of Stewart die-molded castings on this page shows the product as it comes from the mold —compare them with what would have been the result had they been sand cast and machined. Note the clean cut of every tooth in the gear. Here are the two all important qualifications—absolute accuracy and long wearing surface. The production of intricate castings demanding uniformity to the last degree is a simple and economical matter by the Stewart process.

We make die-molded castings in white brass, lead base, tin base and aluminum alloy, for many manufacturers of electrical equipment. It will cost you nothing for complete story as applied to your own requirements. Send a blueprint of one of your small parts today. We will gladly quote on any quantity. Our estimate will show you the big saving in both money and production time.

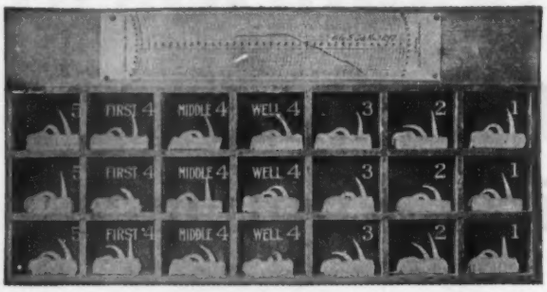
Manufacturers of electrical equipment will be interested in our booklet, "Let us Die-Cast It."

Stewart

STEWART MANUFACTURING CORP.

Also Makers of Stewart Bronze-Back Bearings

4500 Fullerton Avenue CHICAGO, ILLINOIS



A similar photograph is taken after each heat to obtain a permanent record.

The Cone-Plaques Tell The Tale

Kiln-control methods assure the uniformity of

"Pittsburg" Insulators

Not only are pyrometers used to ascertain, and thus maintain, the correct amount of heat in the kiln to make good insulators, but accurate cone plaques are used. How this is done is shown in the photograph above.

These cone-plaques consist of three pieces of fused material having known melting points 20 deg. apart. They can be seen from the outside of the kiln, thus giving an indication of the temperature inside.

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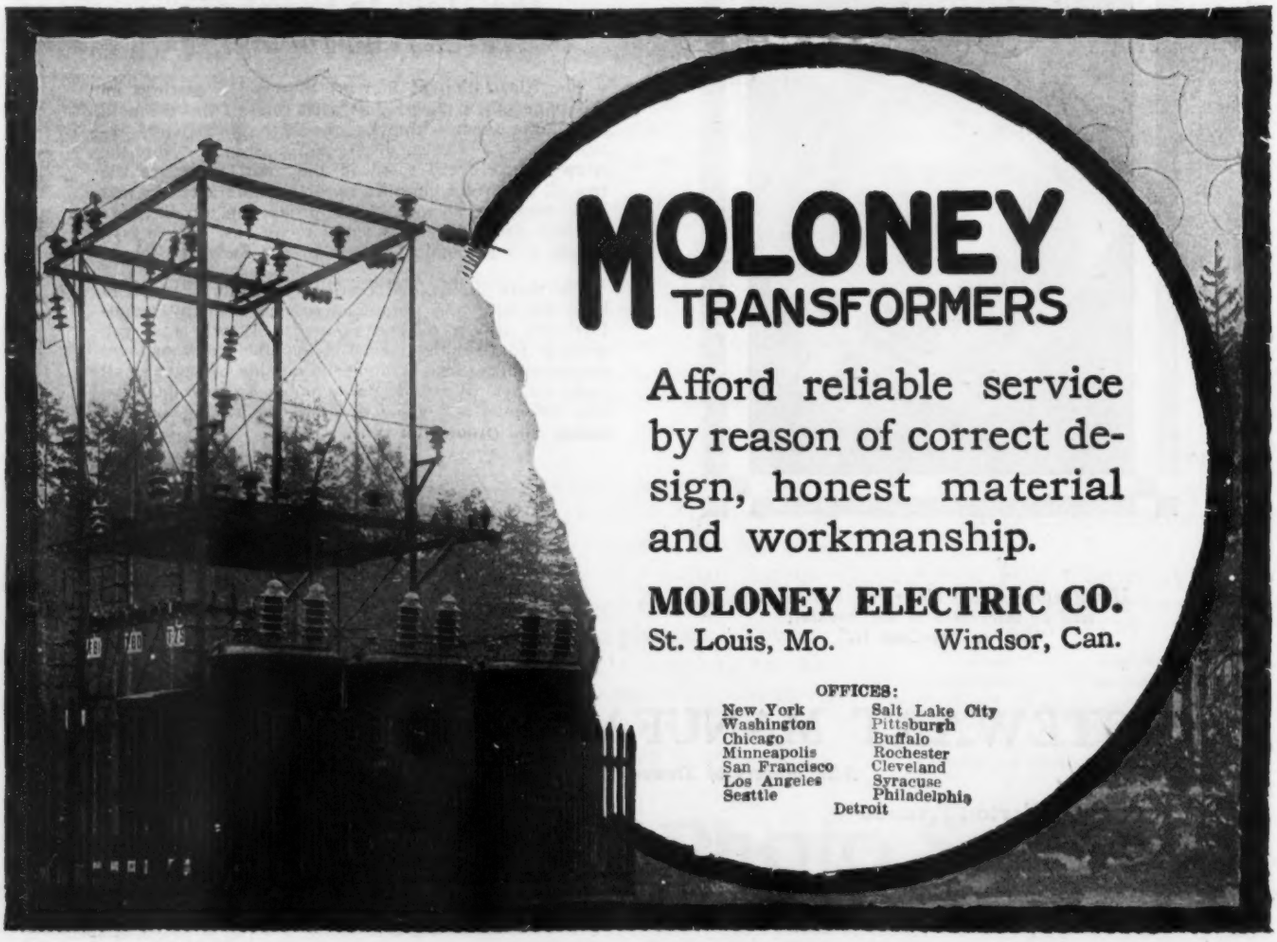

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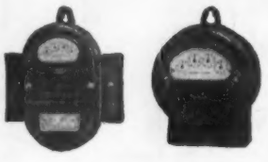

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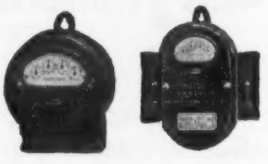

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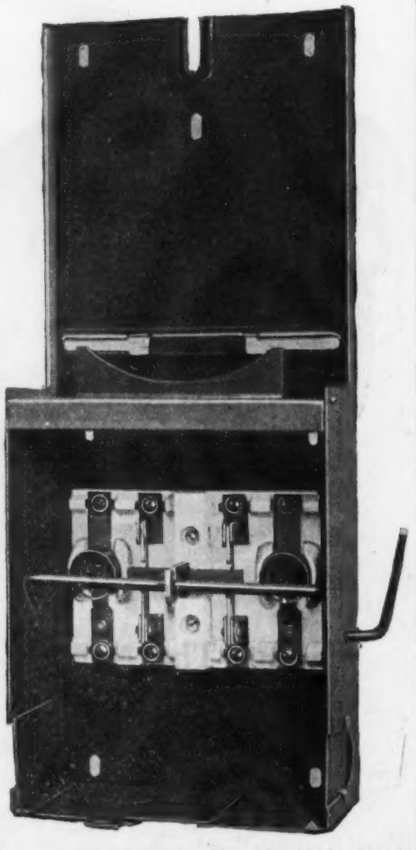

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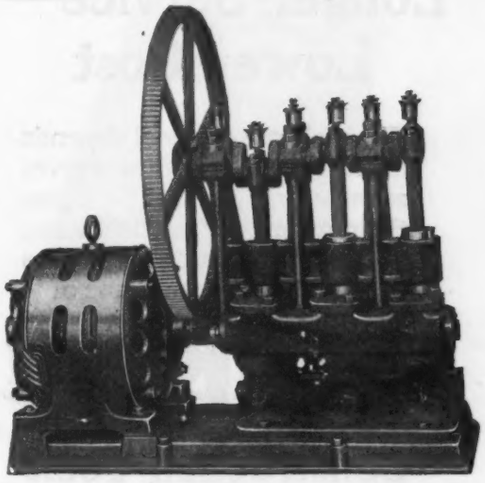

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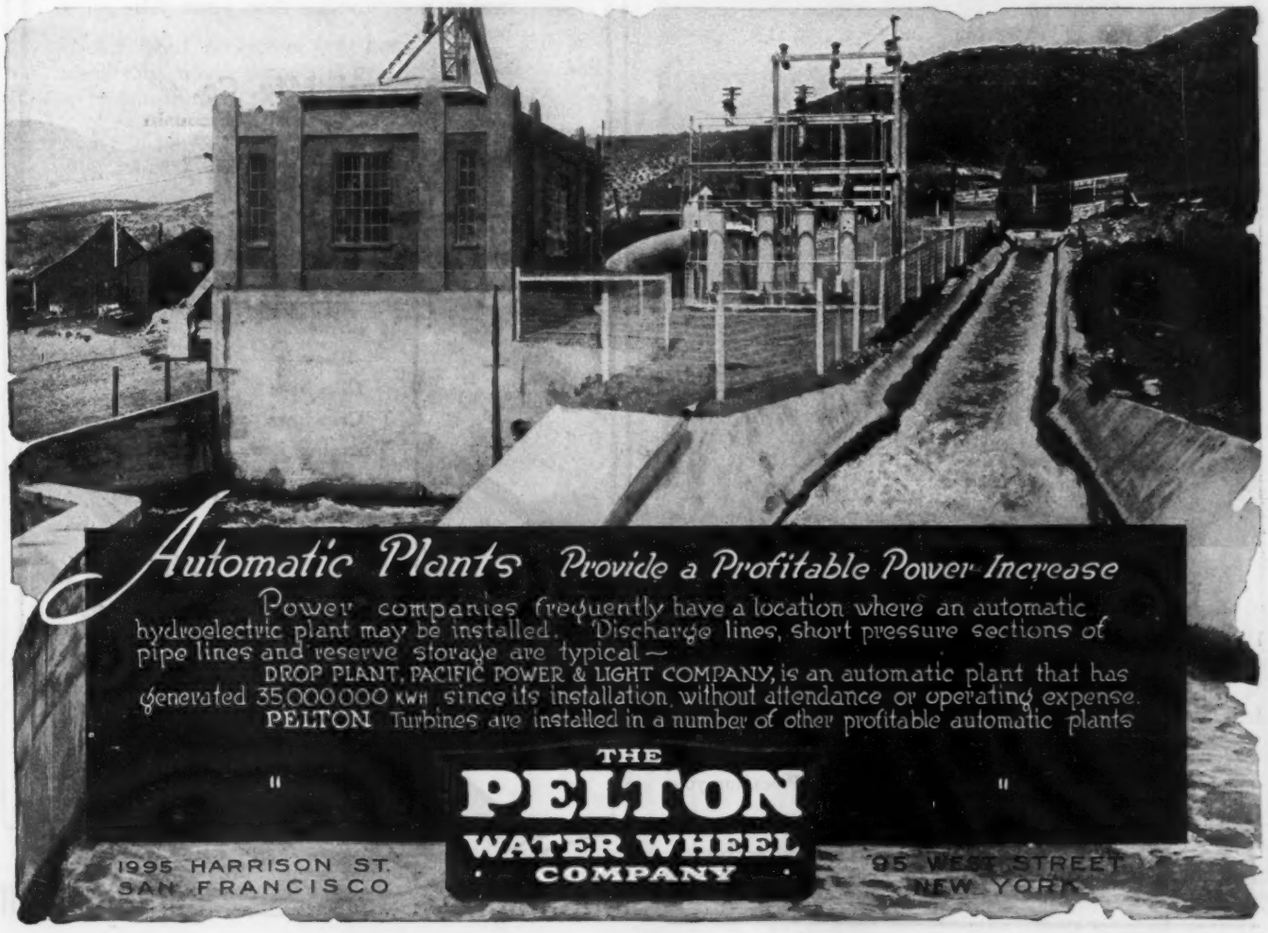
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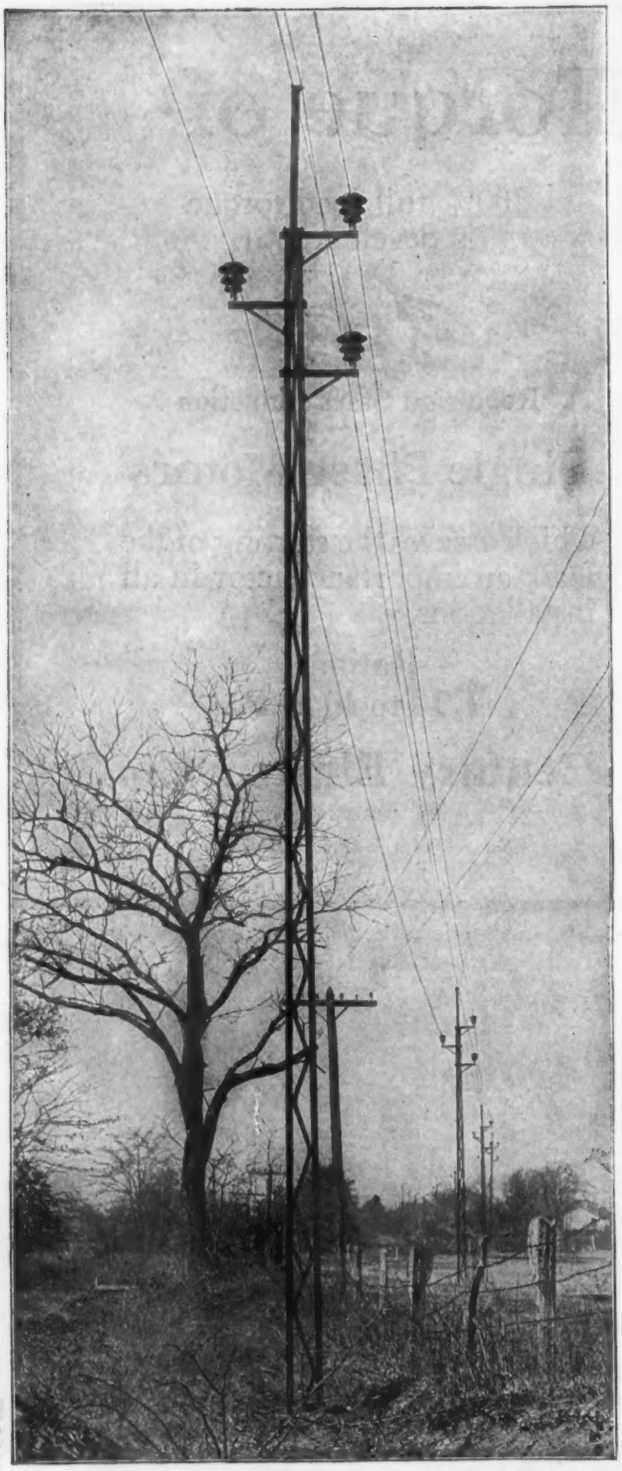

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Jagabi Type "C" Hand Tachometer

This instrument operates on the centrifugal principle, and instantly indicates revolutions-per-minute.

All speed *variations* are shown on the dial immediately, as the pointer is practically deadbeat and very sensitive.

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Write for descriptive Circular 394.

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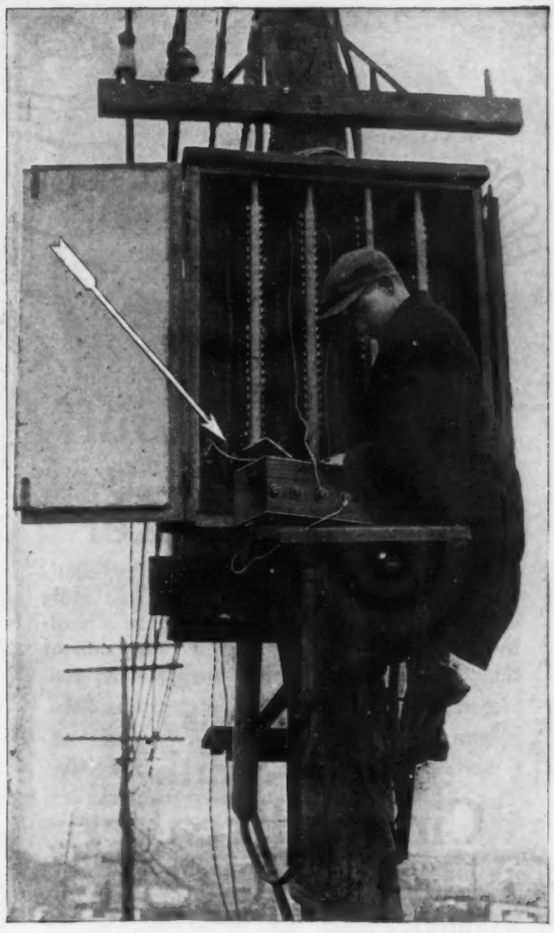

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Megger Method

No instrument other than a Megger can be depended upon to give satisfactory results under circumstances as pictured above; and the same instrument is suitable also for testing generators, motors, transformers, switchboard and other electrical equipment.

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Circuit Breaker

is a dangerous game. But, practically, that's what it amounts to when you have to fumble around for a dinkey tripping device in a hard-to-get-at place, as you MUST with one of those trigger-locked breakers.

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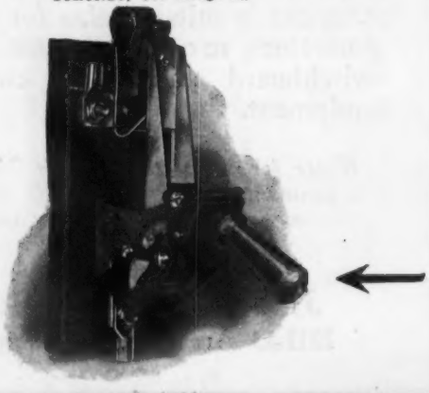

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F-2

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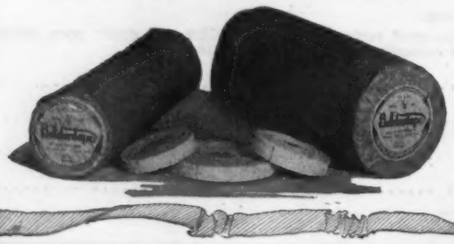

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ANY SIZE

in spools of 1000 meters or rods of 4 mm. thick by 1.40 m. long and 1 mm. thick.

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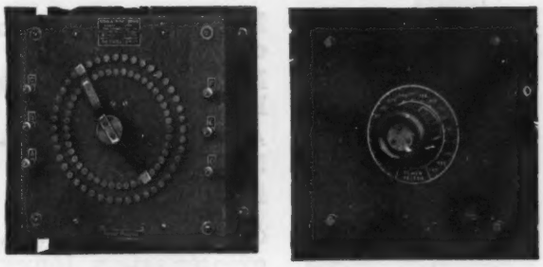

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3

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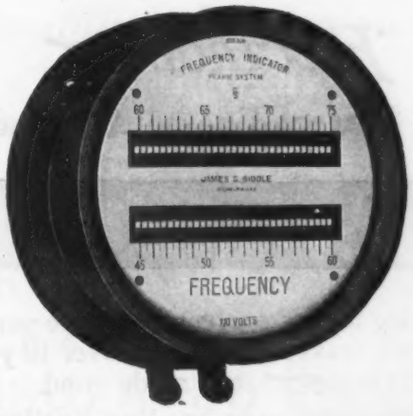

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are specified and used by Engineers who require the *"very best."*

They contain no delicate springs, or moving parts —and are absolutely different in design from any other instruments on the American market.

High initial accuracy is sustained indefinitely—without recalibration.

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Platinum Tipped welded Nickel Base Wires (cylindrical pieces).

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The H. A. Wilson Company
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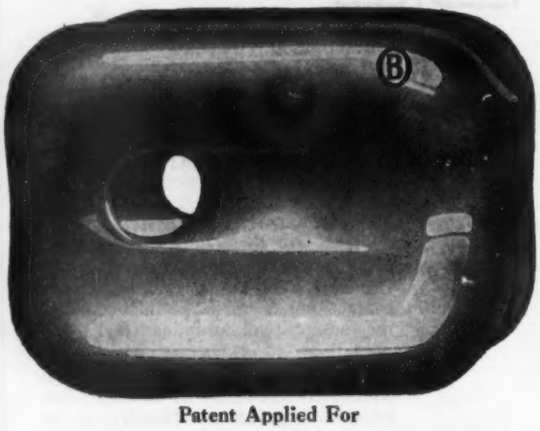
O-B Type X Strain Insulator
for Guy Wires and Dead Ends



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This rugged insulator has an ultimate strength more than 15,000 pounds. It is rated for 1500 volts.

Round corners permit rough handling without breakage. Strands are interlocked.

One of a series of similar sturdy designs.

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AUTOMATIC RECLOSING CIRCUIT BREAKER

"THE CIRCUIT BREAKER WITH BRAINS"

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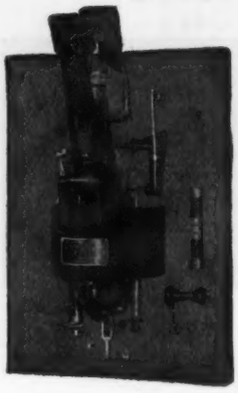

Not only when to open
But also WHEN TO RECLOSE
And does it AUTOMATICALLY
For the sake of
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"Let's Get Acquainted"

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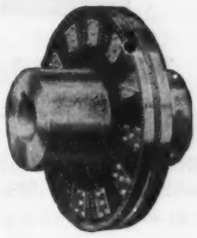

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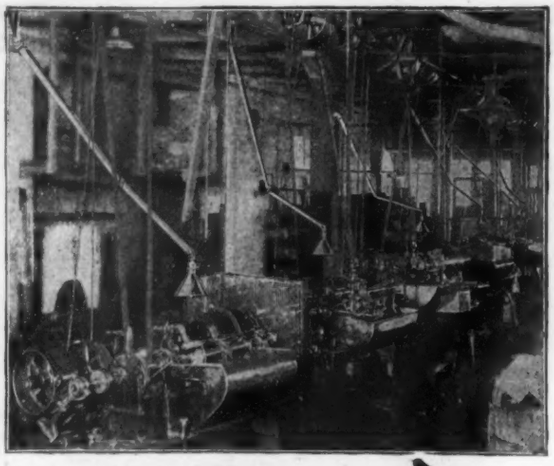

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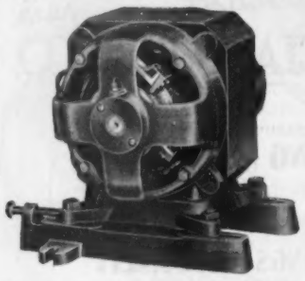

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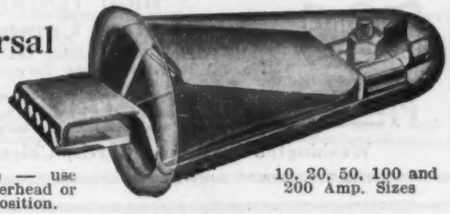

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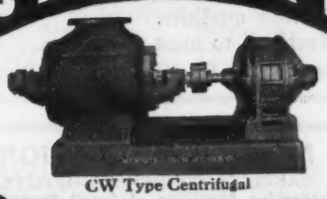

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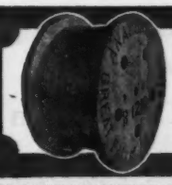

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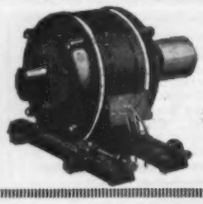

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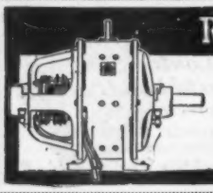

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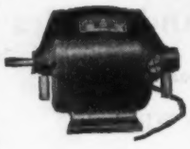
1046 Ivanhoe Rd., Cleveland, O.



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32-110-220 Volts
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are made by the Wm. B. Durgin Co.
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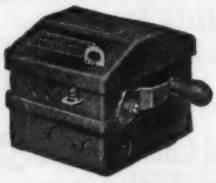

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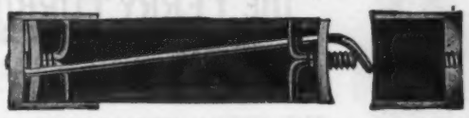

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are revolutionizing the making of yellow brass.
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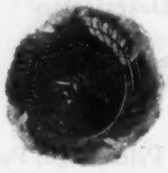

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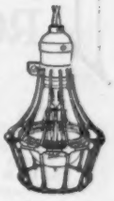

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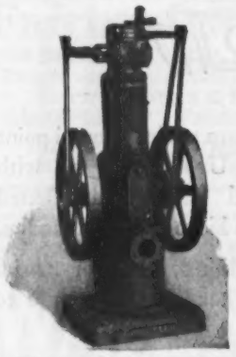

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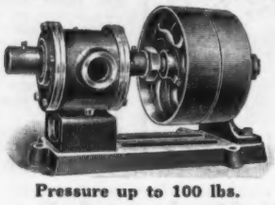

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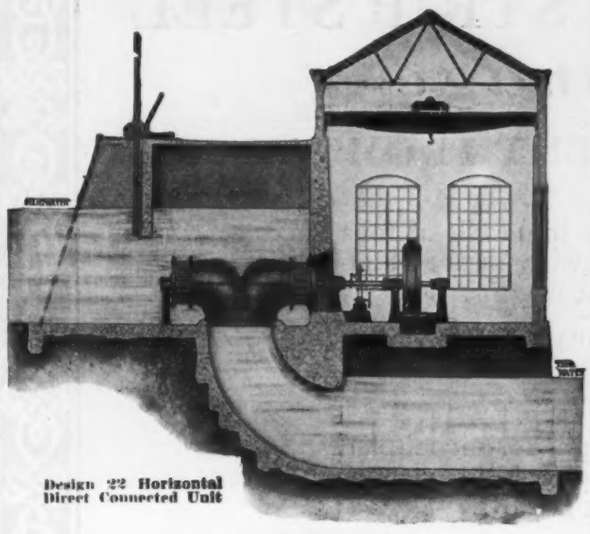

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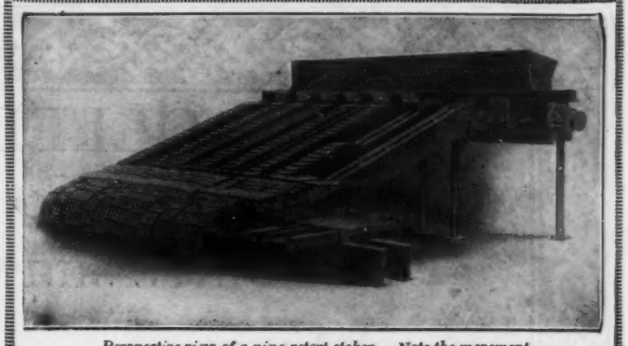

Perspective view of a nine-retort stoker. Note the movement of the grates and rocker plates.

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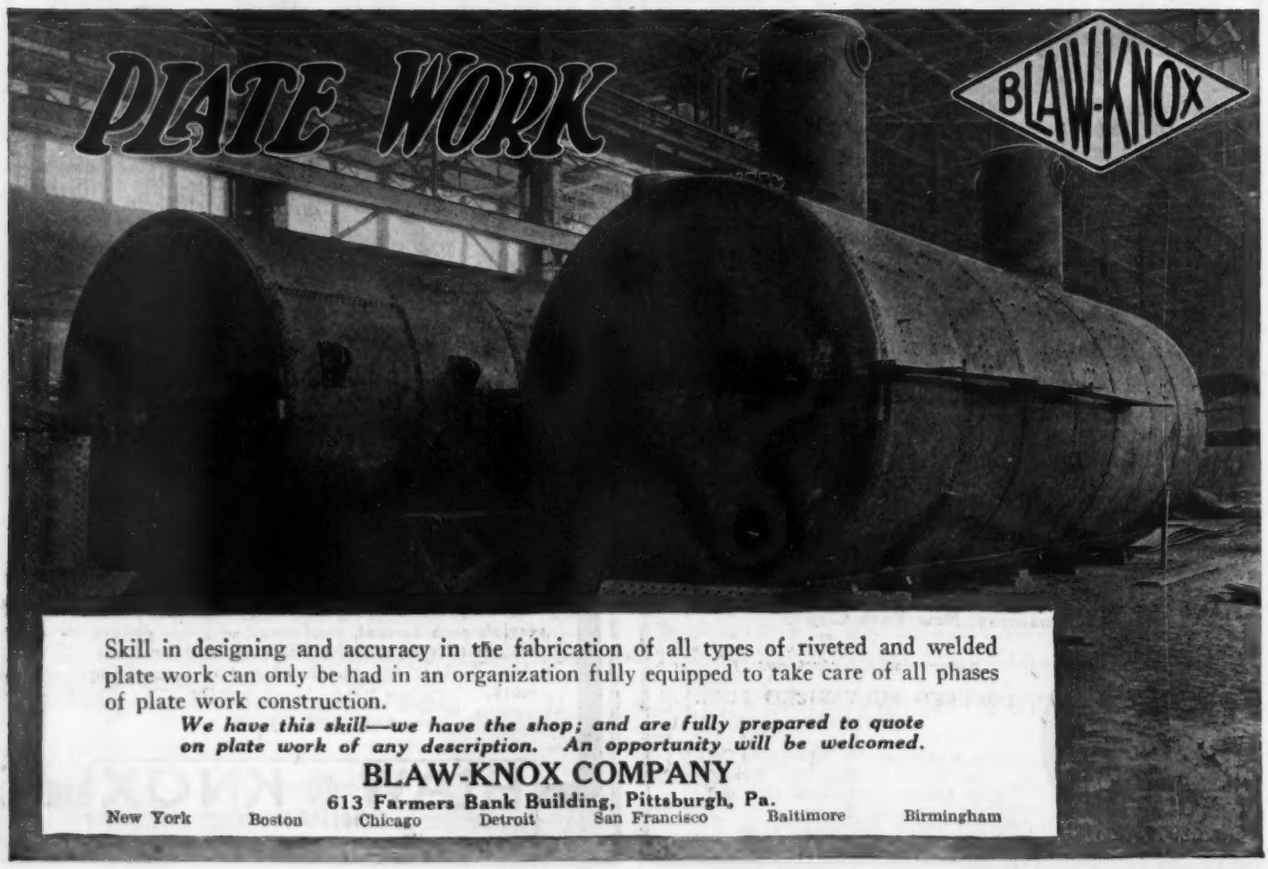

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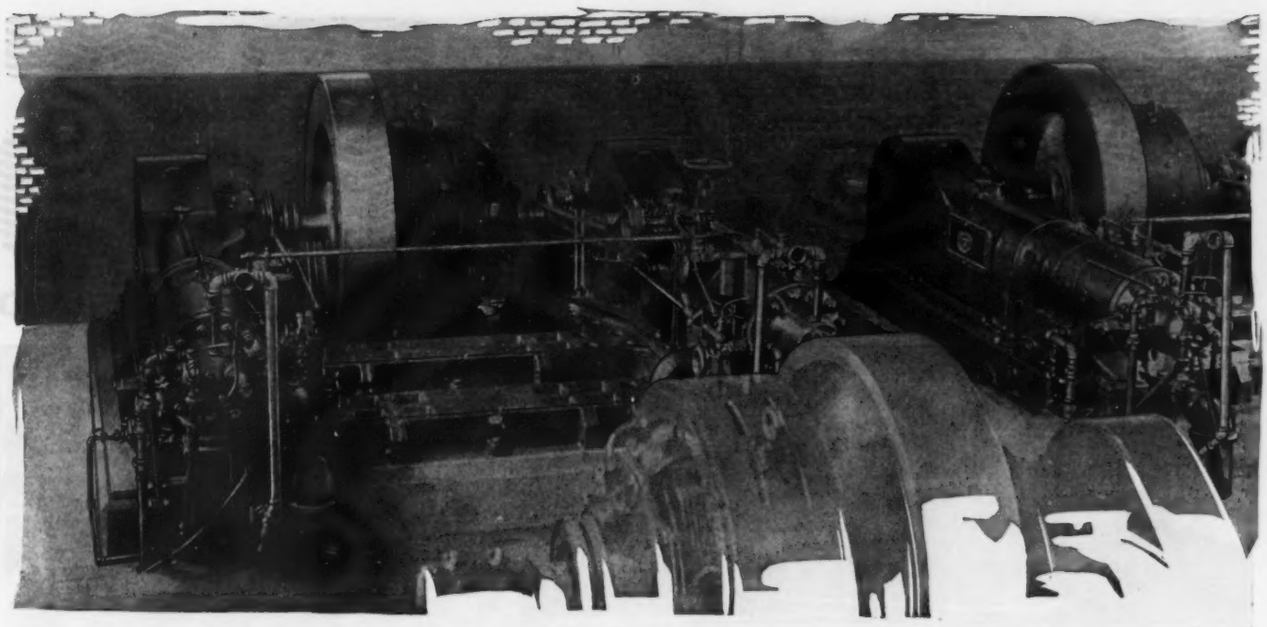

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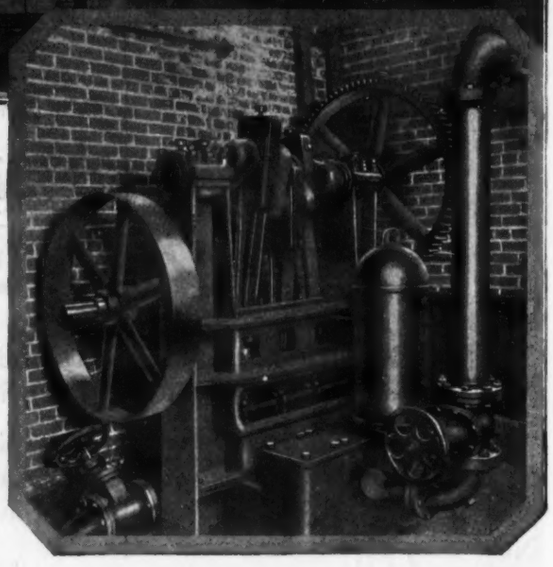

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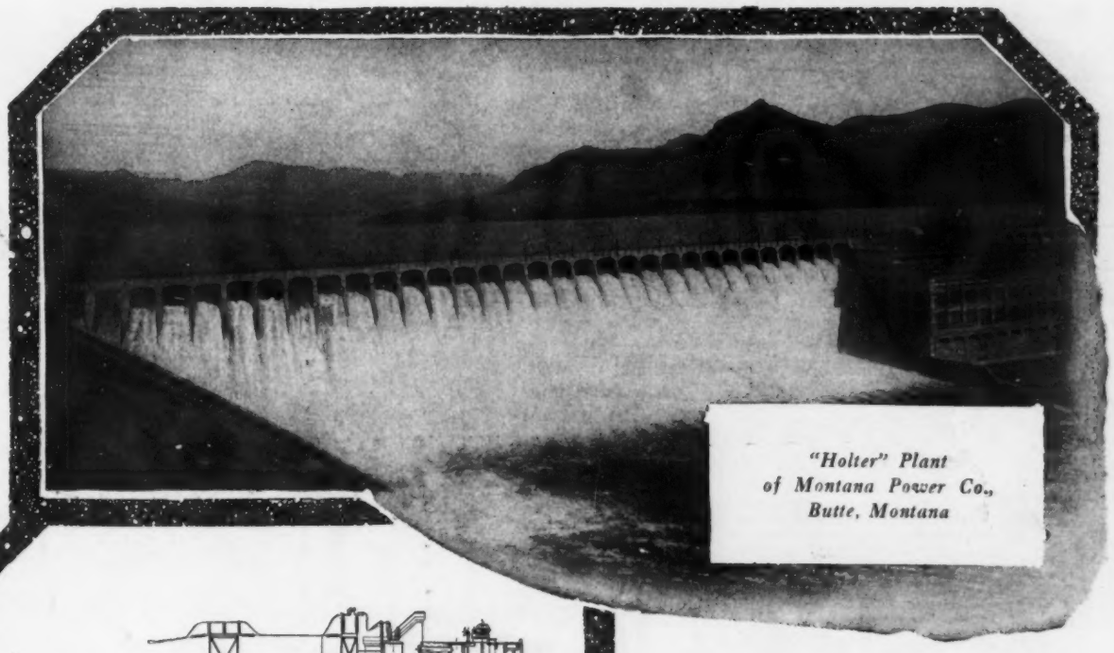
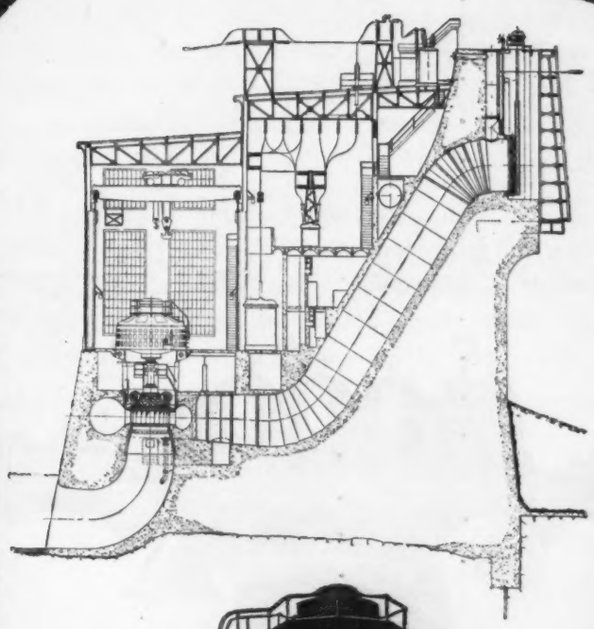
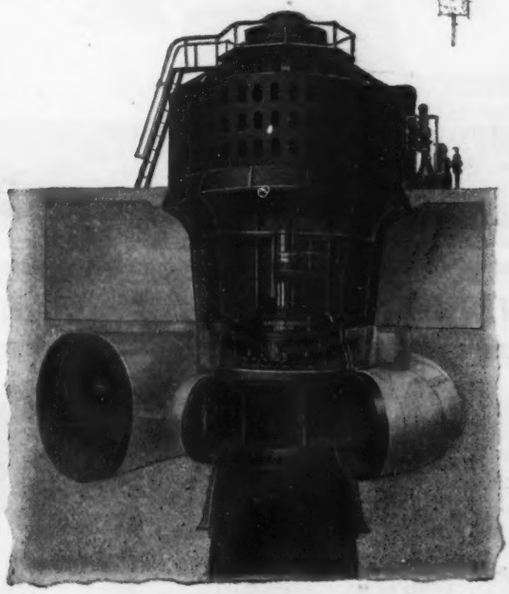


"Holter" Plant of Montana Power Co., Butte, Montana





Approximately 300,000 Horse Power Developed by

SMITH
Hydraulic Turbines

in the various plants of the Montana Power Co.

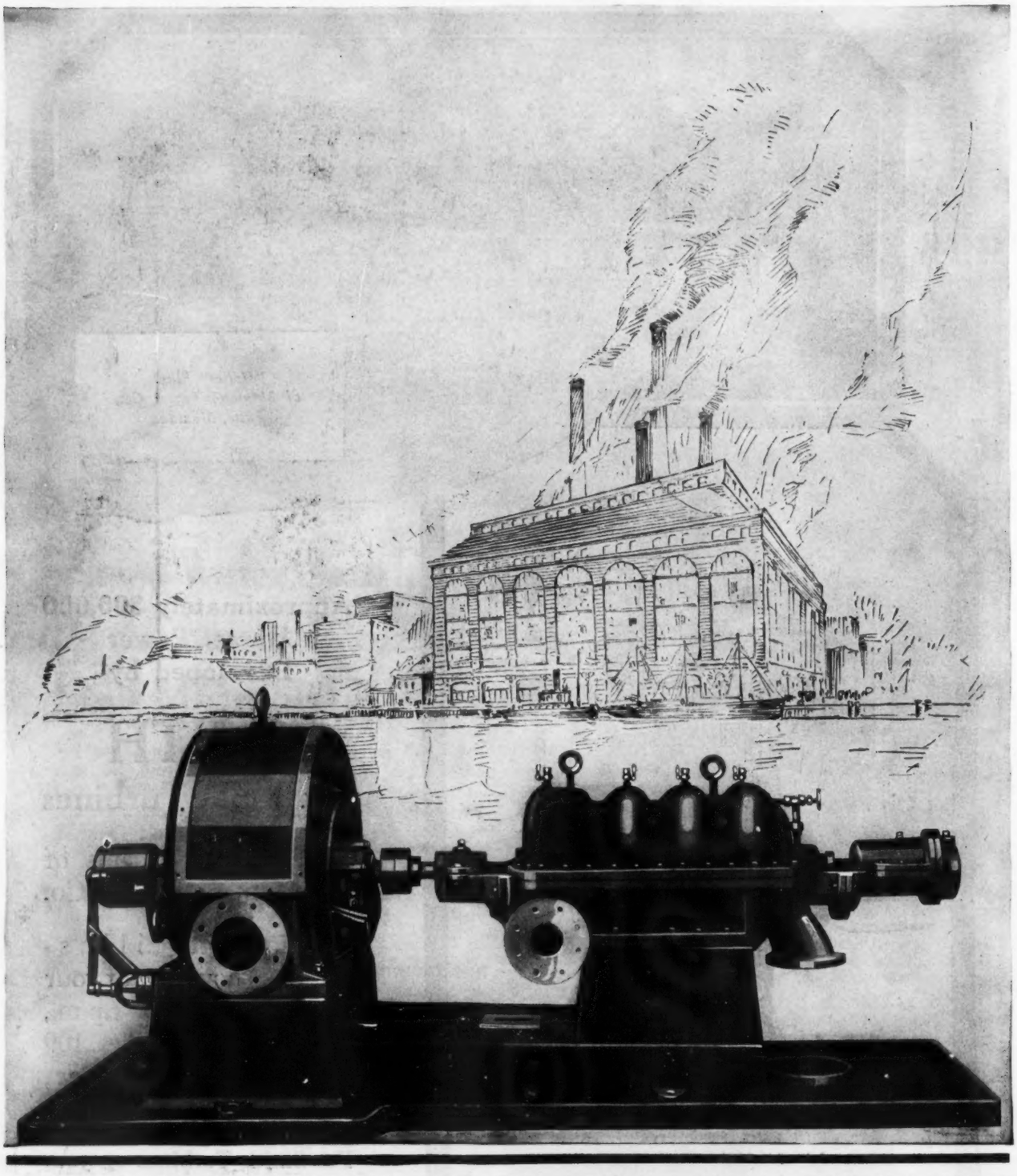
Accompanying illustrations show one of four 17,000 hp., 150 r.p.m., units installed under 109 foot head at Holter, Montana.

Put Smith Turbines on your 1921 Program for Efficient and *Dependable* Service.

Write Dept. "W" for Bulletin

S. Morgan Smith Co.

York, Pa., U. S. A.



PUMPS — COMPRESSORS — CONDENSERS — OIL & GAS ENGINES

WORTHINGTON

Deane Works, *Holyoke, Mass.*
Blake & Knowles Works
East Cambridge, Mass.
Worthington Works
Harrison, N. J.
Laidlaw Works, *Cincinnati, Ohio.*

Hazleton Works, *Hazleton, Pa.*

Gas Engine Works, *Cudahy, Wis.*
Power & Mining Works
Cudahy, Wis.
Snow-Holly Works
Buffalo, N. Y.
Epping-Carpenter, *Pittsburgh, Pa.*

Worthington Satisfies All Boiler Feed Conditions

SINCE there is no way to eradicate the danger of a centrifugal boiler feeder becoming "steam bound," Worthington has eliminated the consequent damage to the pump by a special device.

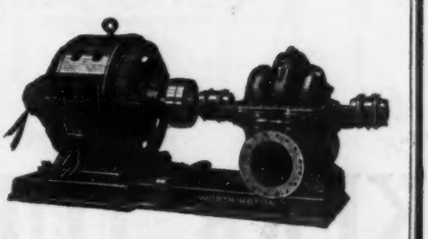
The least effect from a pump becoming "steam bound" is decreased capacity and inefficiency. But worse than that, the close clearance points between rotor and casing often bind, and wreck the pump.

Worthington has insured against pump wreckage from that cause by building into the Worthington double suction centrifugal boiler feeder a distinctive sealing ring design of the floating type.

This refinement proofs the pump against one of the greatest sources of trouble in centrifugal pump boiler feeding and is typical of how Worthington has developed and improved pumps and pumping machinery since 1840.

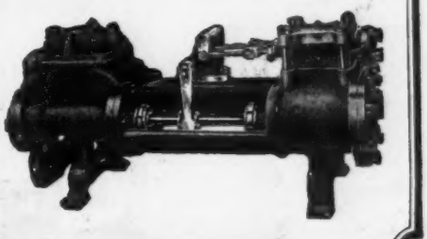
WORTHINGTON PUMP AND MACHINERY CORPORATION
Executive Offices: 115 Broadway, New York City
Branch Offices in 24 Large Cities

Centrifugal Pumps



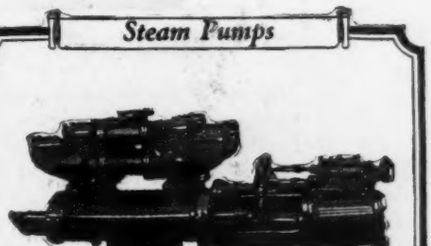
Worthington Split Case Double Suction Volute Pump

Steam Pumps



Worthington Duplex Packed Piston Pump
A general service pump of compact design for water pressure not to exceed 200 pounds

Steam Pumps



Worthington Pot Valve Boiler Feed Pump

W-377.88

METERS — MINING — ROCK CRUSHING & CEMENT MACHINERY

WORTHINGTON

Deane Works, *Holyoke, Mass.*
Blake & Knowles Works
East Cambridge, Mass.
Worthington Works
Harrison, N. J.
Laidlaw Works, *Cincinnati, Ohio.*
Hazleton Works, *Hazleton, Pa.*
Gas Engine Works, *Cudahy, Wis.*
Power & Mining Works
Cudahy, Wis.
Snow-Holly Works
Buffalo, N. Y.
Epping-Carpenter, *Pittsburgh, Pa.*

KERR TURBINE COMPANY

Wellsville, N. Y.

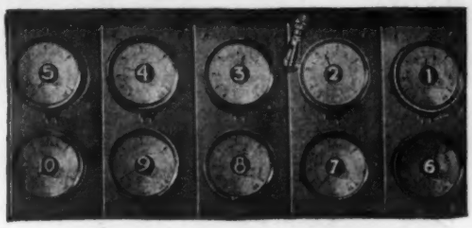
Economy

Steam Turbines

REPUBLIC

ONLY ELECTRICALLY OPERATED

FLOW METERS



You Can Depend Upon These Records

Records of fuel efficiency—records of the performance of individual boilers—records of power costs—all of these valuable guides to efficient plant operation are made doubly valuable by the dependability of these records.

In the Republic system the reading instruments may be grouped on a centrally located instrument board. They show momentary plant conditions and make a 24-hour graph that enables you to trace every leak that may develop to curtail boiler output.

The Advantages of Electrical Operation

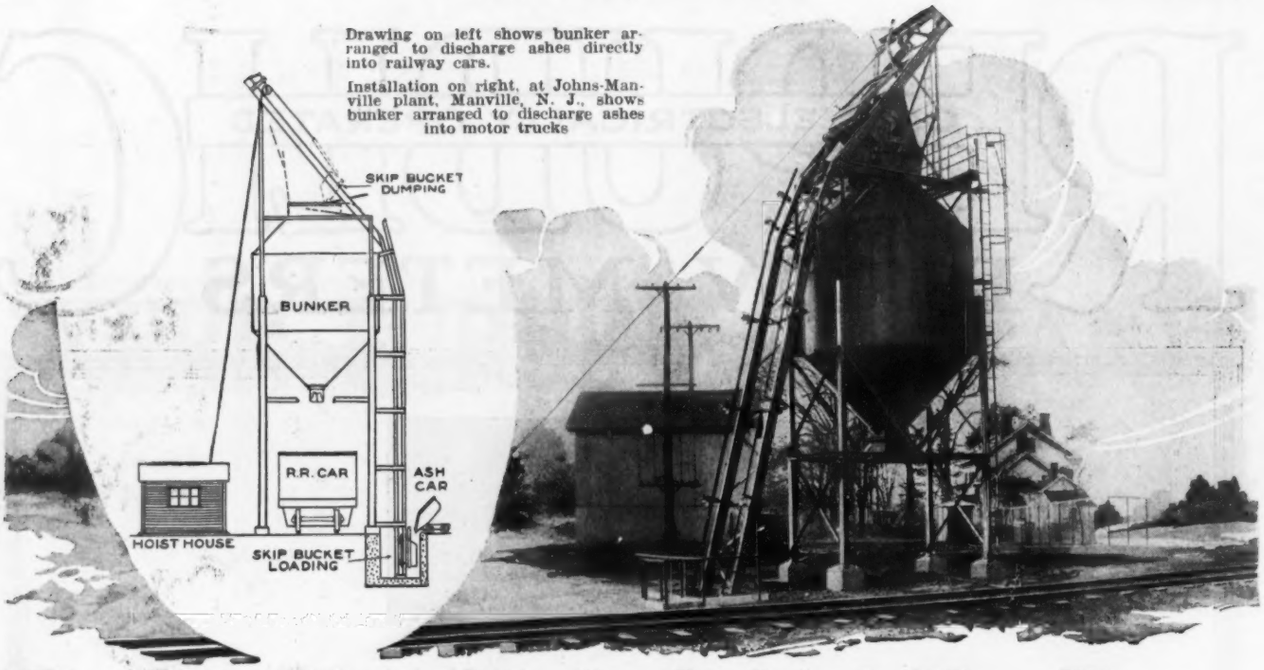
Differential Pressure, the principle on which all meters operate, is not depended upon to actuate the reading instruments of Republic Flow Meters. It merely establishes contacts with a series of resistances which control the reading instruments. This permits the elimination of all moving parts in the meter body. Therefore, in the Republic the recognized advantages of measuring steam flow are intensified by the greater flexibility and dependable accuracy that is a direct result of electrical operation of reading instruments.

Let us show you why the electrical principle of measuring steam flow offers a wide range of practical application for every type and size of plant.

REPUBLIC FLOW METERS CO.
2240 DIVERSEY BOULEVARD
CHICAGO

New York Philadelphia Pittsburgh Boston Detroit Atlanta Toronto

Republic System



Drawing on left shows bunker arranged to discharge ashes directly into railway cars.

Installation on right, at Johns-Manville plant, Manville, N. J., shows bunker arranged to discharge ashes into motor trucks

The Skip Hoist Method of Ash Handling—Low in Cost, High in Efficiency

Have you ever figured out just what the handling of ashes in your plant costs? Ash handling may be one of the most wasteful, inefficient operations in your plant. The old, man-and-wheelbarrow method of ash handling is too costly and inefficient. Other systems show unnecessary labor costs and repair bills. Regardless of what method of ash handling you consider, you will find that the Beaumont Skip Hoist method shows up to a better advantage on the profit side of the ledger.

The Beaumont Skip Hoist System handles ashes quicker and with less amount of labor. It consists of a bucket running on inclined or vertical tracks hoisted by a steel cable and winding machine. A small push or electric car is used to collect ashes from hoppers under the boilers. The ashes are dumped into the bucket and a push of a button starts it up the incline, dumps the ashes into the bunker and returns the car. From the time the ashes are dumped into the skip bucket until the bucket returns for another load, the entire operation is automatic. This system will economically handle from eight tons an hour and up.

The dependability and economy of the Beaumont Skip Hoist can best be gauged by the following distinct advantages over other systems. The Skip Hoist is the only mechanical ash handling system which is not affected by the abrasive action of hot, dripping wet ashes and grit.

Low operating cost made possible because only *one* unskilled laborer is required and a minimum of power; low upkeep expense because there are no complicated parts to break down or repair; low installation cost because fewer and simpler parts are used than in any other system—are commendable features of the Beaumont Skip Hoist.

An investigation of the Beaumont Skip Hoist System of Ash Handling as compared with the one now used in your plant, may prove interesting from the standpoint of dollars saved. The Beaumont book—"The Skip Hoist for Coal—Ashes—Coke" will be sent upon request.

Beaumont
ONE CONTRACT
ONE RESPONSIBILITY

A Few Plants Using Beaumont Equipment

Atlantic Refining Co.
Philadelphia.

Carnegie Steel Co.
Farrel, Pa.

Consolidated Gas, Electric Light & Power Company
Baltimore, Md.

Detroit City Gas Co.
Detroit, Mich.

Fitzdale Paper Co.
Fitzdale, Vt.

General Electric Co.
Schenectady, N. Y.

General Electric Co.
Pittsfield, Mass.

Welsbach Company
Gloucester, N. J.

Beaumont Company specializes only on boiler houses and equipment used in their operation, and does not enter into any other kinds of engineering and construction work. It seems conservative, therefore, to claim that their organization is better qualified in size, knowledge and experience for this one class of work than any other in the country.

R·H· BEAUMONT CO·

Coal and Ash Handling Systems for Boiler Houses

328 Arch Street Philadelphia

Protect against boiler feed water trouble—

Reilly Evaporators

Self Scaling

supply pure, distilled water for boiler feed and afford complete protection against boiler feed water troubles.

Advantages

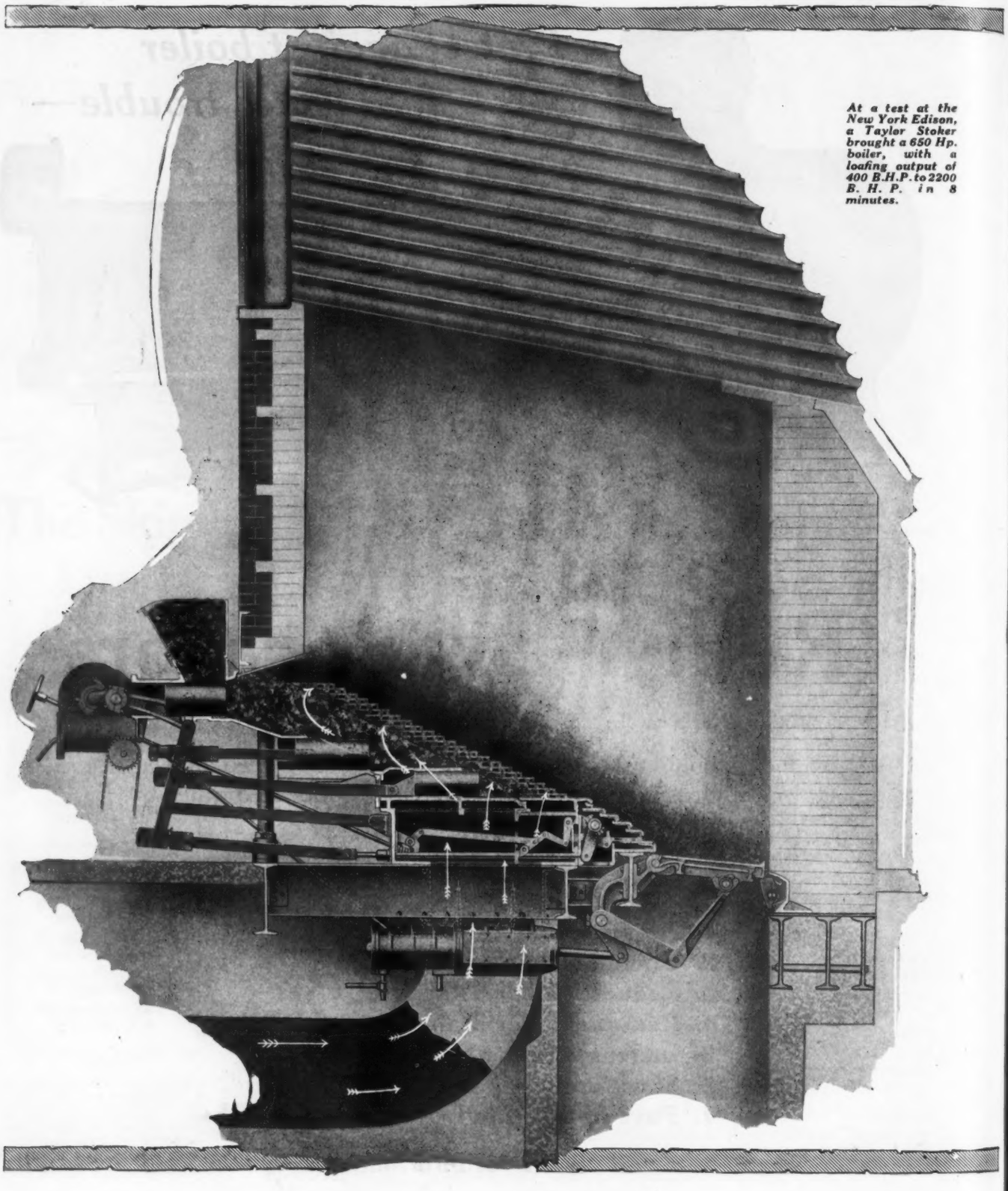
1. **Prevents Boiler Scaling.**
2. **Eliminates Blowdown.**
3. **Reduces Boiler Takedown.**
4. **Reduces Boiler Maintenance.**
5. **Increases Boiler Capacity.**
6. **Saves on Labor and Coal Costs.**
7. **Pays for itself in from 12 to 18 months.**

Write for information

The Griscom-Russell Co.

2119 West Street Building, New York

Philadelphia	Pittsburgh	Chicago	Houston	Seattle
Boston	Cleveland	Minneapolis	Fort Worth	Los Angeles
Hartford	Toledo	St. Louis	Charlotte	Kansas City
Springfield	Detroit	New Orleans	San Francisco	Milwaukee



At a test at the New York Edison, a Taylor Stoker brought a 650 Hp. boiler, with a loafing output of 400 B.H.P. to 2200 B. H. P. in 8 minutes.

The Taylor Stoker equipped with Power Dump.
Completely mechanicalizes the conversion of coal into steam.

The Taylor Stoker Carries a Thicker Fuel Bed than Any Other System

Because it is designed with deeper retorts than any other stoker. In these deep retorts two and sometimes three rams pack the fuel to the proper degree of compactness so that when it reaches the tuyere level, the fuel spreads over the entire furnace area in a deep, compact, yet porous fire-bed.

This fact has three important results:

(*a*) The coal cokes more slowly releasing all the volatile gases. These are promptly and intimately mixed with air while passing through the thick bed of fuel into the combustion zone where they are completely burned.

(*b*) The thick mass of coke on the grates is ready for emergencies. When an increased air supply is sent through this mass, the Taylor Stokered boiler can be lifted from rated capacity, or from a banked condition, to 200% or 300% of rating in a few minutes.

(*c*) The grate surface is always protected by green coal.

Taylor Stoker users find that they can maintain higher efficiencies than with any other firing system, whether operating at rating or at high overratings—and with less effort.

If you are interested in further information, drop us a line for the interesting booklet "Today's Problems and The Taylor Stoker"

American Engineering Company

Philadelphia, Pa.

Taylor Stoker Co., Ltd., 416 Phillips Place, Montreal, Canada.

Builders of

The Taylor Stoker

Ideal Combus
can be attained

But—can you maintain those conditions in regular operation?

Nearly every power plant operator can get just the right air supply, the right rate of combustion, the proper fire thickness, for correct combustion, by careful attention to all details of fire room practice. But *maintaining* the proper adjustment of all the elements that go to make up efficient combustion is another matter. Changes of load, changes in individual fire thickness and a host of other detail fluctuations make the most careful hand regulation fall far short of the requirements of modern practice.

The Gray System of Automatic Combustion Control follows every fluctuation of steam pressure, every change in individual furnaces, to maintain combustion conditions at the pre-determined most desirable point.

The adjustment of dampers and forced draft together with control of stoker drive, follows accurately and instantly any change in steam demand. Coordinated control is designed to maintain predetermined overfire draft at a constant amount. Any variation in fuel bed re-

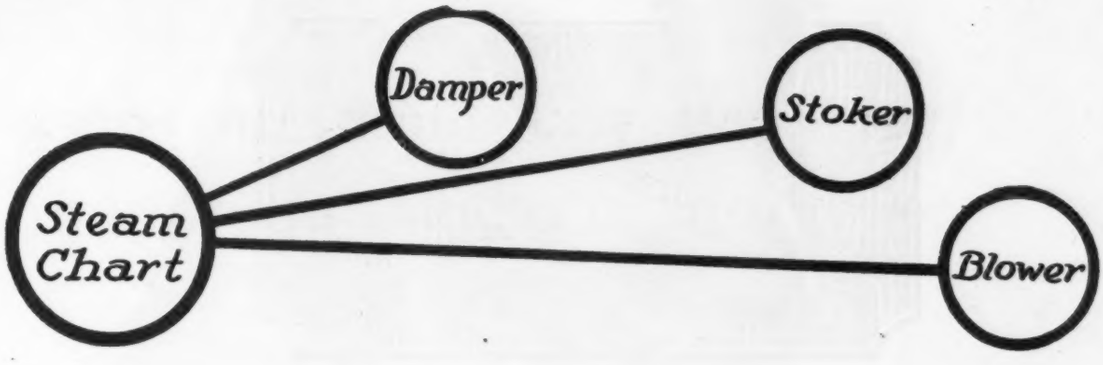
AUTOMATIC COMBUSTION CONTROL saves coal TRADE MARK
GRAY SYSTEM

Automatic Fuel

Combustion Engineers

350 Machinery Hall, Chicago

tion Conditions
periodically



sistance, in damper setting or other element which alters this correct overfire draft is met by an immediate and accurately set change in blower speed. So sensitive is the control that overfire draft does not change more than 6 to 8 hundredths of an inch.

The Gray System is extremely simple in design and operation, and does not introduce any difficulties to offset the increased capacity and saving in fuel obtained. It operates upon a logical method, designed upon sound engineering principles.

The value of the Gray System of Automatic Combustion Control in your own plant is unusually important with the present coal situation. Complete description of the apparatus and its method of operation will be sent upon your request. Ask for "Automatic Combustion Control."

"Help for You"

Saving Company

and Contractors

1061 Bulletin Bldg., Philadelphia

AUTOMATIC COMBUSTION CONTROL
TRADE saves coal MARK
GRAY SYSTEM

The *Signal* Nozzle steam jet ash con- It is fully described

The steam jet ash conveyor is invariably operated by the lowest type of labor to be found around a power plant—the type which will operate any piece of equipment until it breaks down.

The steam nozzle of every steam jet system controls two factors which are vital to satisfactory performance; first, steam consumption; second, maintenance costs.

The nozzle directly controls steam consumption. As soon as its throat or orifice becomes enlarged, to be sure, steam consumption increases—and at an alarming rate.

But a secondary effect is also introduced and one which has a more serious ultimate effect than steam waste. With a greater volume of steam going through the system the ash velocity has been increased. It results in an extremely vicious scouring action which increases maintenance to an excessive figure.

Thus the nozzle controls these two factors which determine the ultimate success or failure of the entire system.

If steam consumption and maintenance costs are to remain reasonable, the steam nozzle must be foolproof. It must be so designed that the system cannot be operated when steam consumption exceeds a certain predetermined amount.

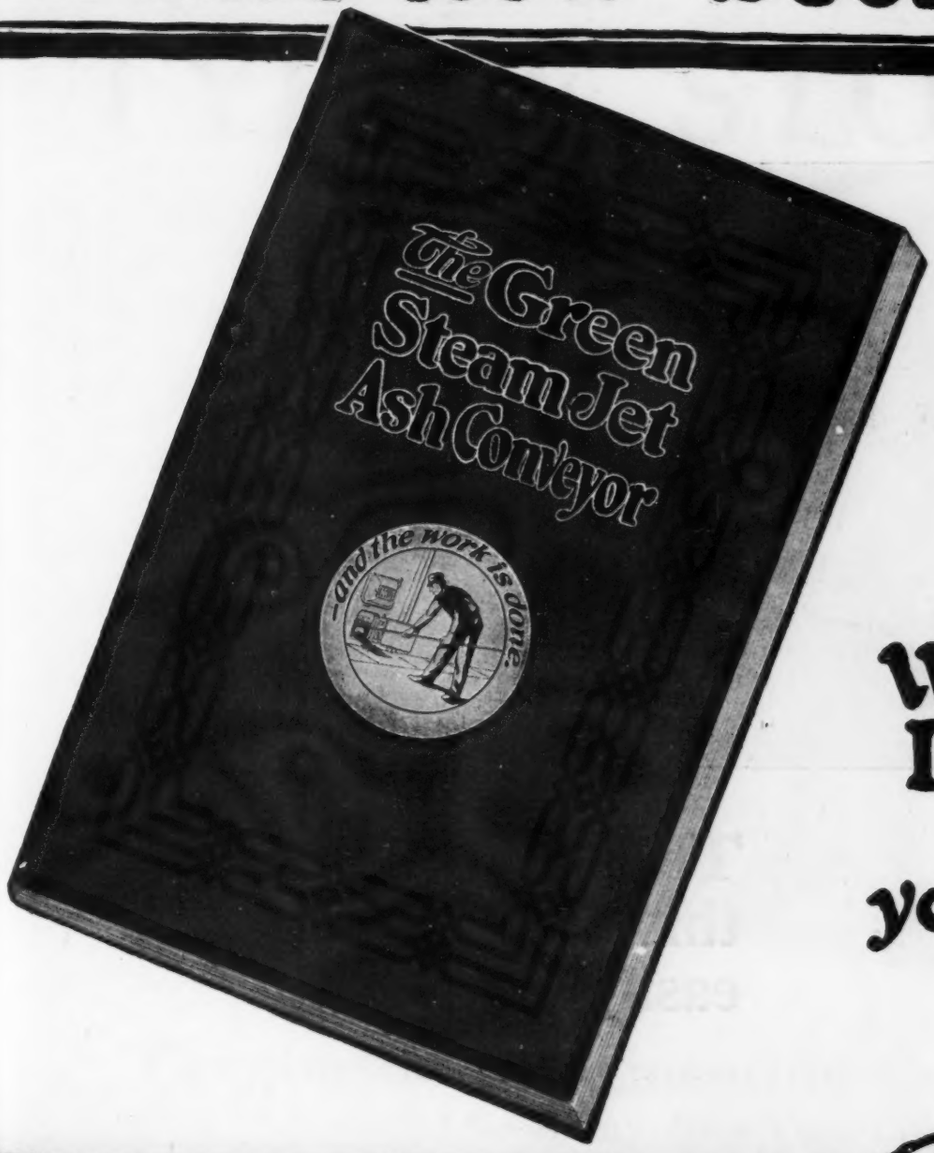
The new Green Steam Jet Ash Conveyor has been making records for low cost of operation. The reason can be largely found in the design and application of the Green *Signal* Nozzle. It is fully described in the new Green Steam Jet Book. Write Department B for your copy.

Green Engineering Company

80 Kennedy Ave., East Chicago, Indiana

GREEN

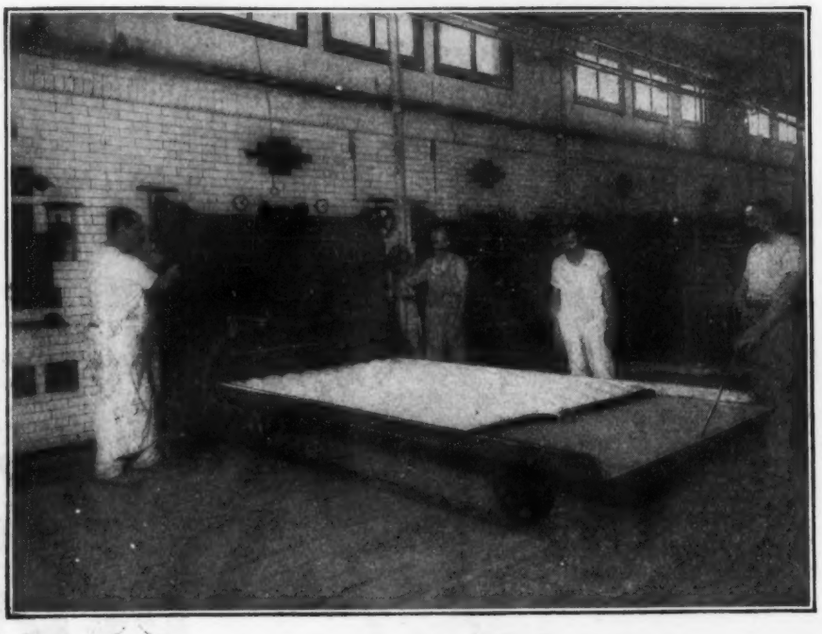
has revolutionized ~veyor performance. in this new book..



Write to Dept B for your copy

Steam Jet Ash Conveyor

EASE OF IN



The "batch" for this oven is easily handled.

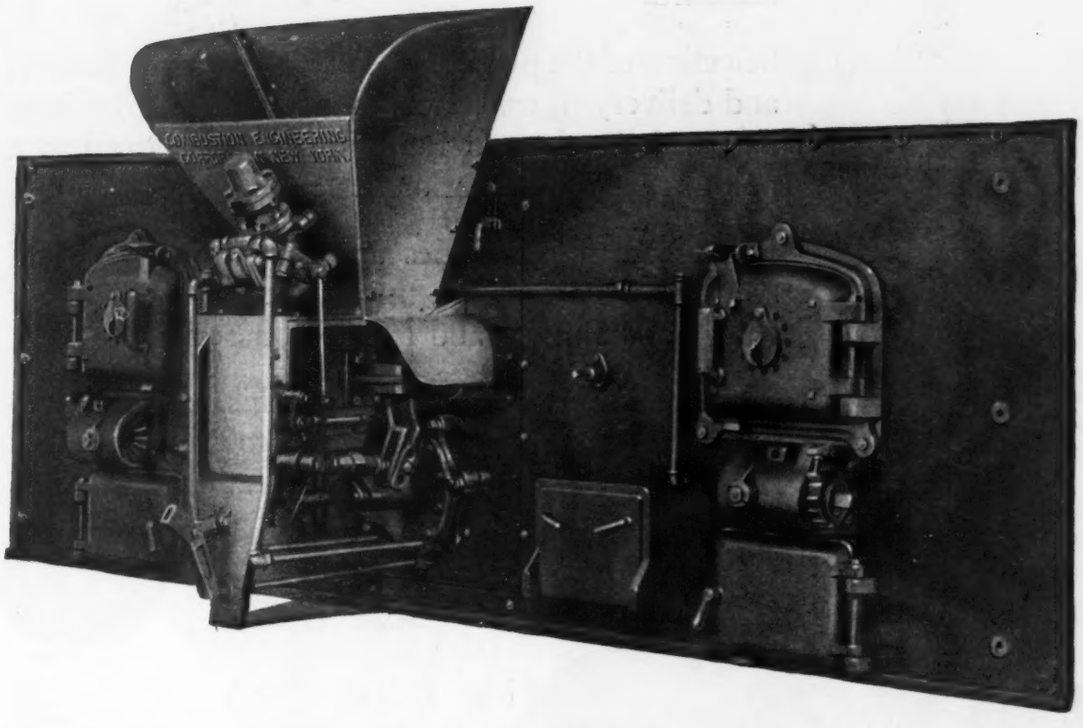
Economy
Capacity
Simplicity
Ease of Operation
Ease of Installation √

STALLATION

The Installation of

TYPE E STOKERS

makes it easy to handle any load



Combustion Engineering Corporation

11 Broadway, New York City

Owners and Manufacturers of

Lopulco Pulverized Fuel Systems

Type E Stokers—for Bituminous Coal **The Grieve Grate—Hand-Firing**

Coxe Stokers—Anthracite Coal and Coke Breeze

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HAZLETON, PA. BOSTON, MASS. CHICAGO, ILL. DENVER, COLO. SALT LAKE CITY, UTAH ALBANY, N. Y.
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TAYLOR ENGINEERING CO., VANCOUVER, B. C.

a business standard

All the Power—All the Time

ROCKWOOD PULLEY SERVICE

ROCKWOOD *Service* to motor manufacturers and motor users has set an unusually high standard.

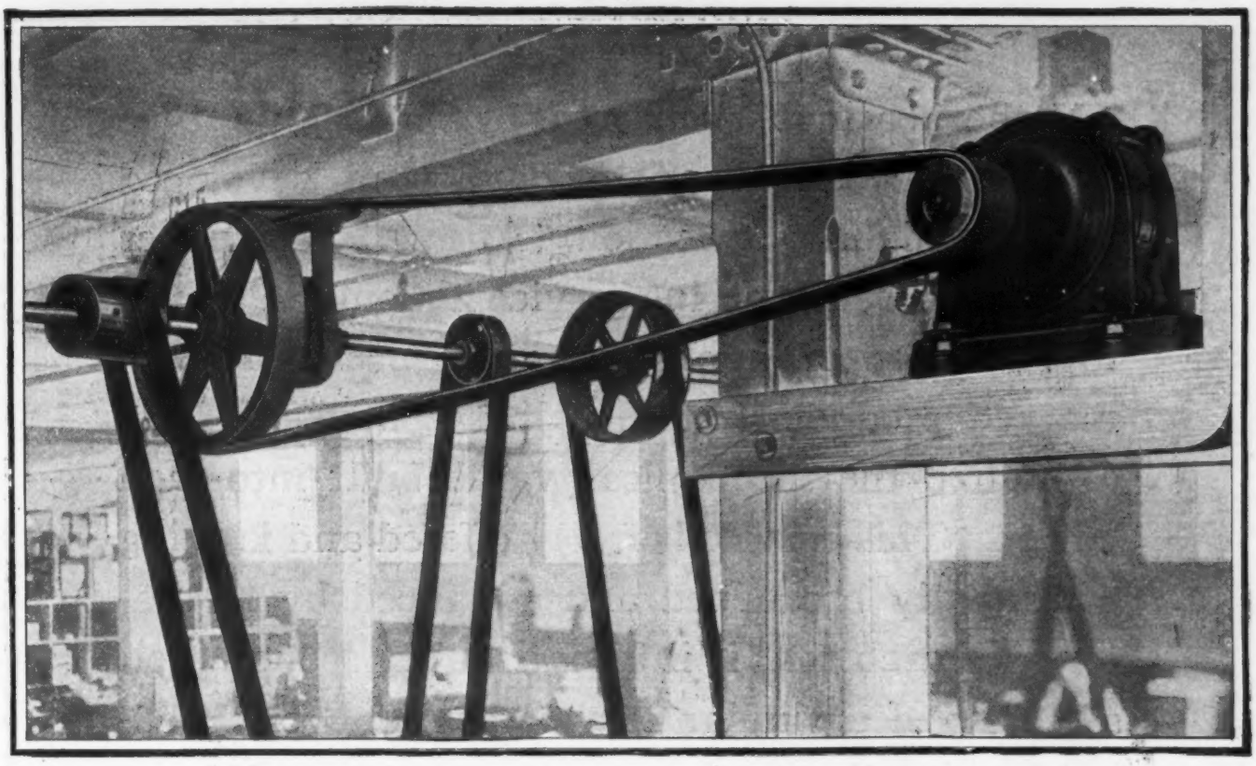
Selection of the proper type of pulley, manufacture, and delivery in exact accordance with instructions, has, with Rockwood Pulleys, been developed to a point of obvious superiority.

Manufacturing facilities are being expanded and adjusted to care for an unprecedented demand for Rockwood Pulleys and Rockwood Service.

Anticipation of Pulley needs at this time by manufacturers and users will do much to relieve the tension under which we have been handicapped.

The Rockwood Manufacturing Company

Indianapolis, Indiana.



Motor doctors prescribe leather belts for long life

THE direct connected motor—bearing the racking strain of sudden stops and starts—loads constantly fluctuating, dropping from full to nothing, leaping from nothing to a full heavy load—is it any wonder that the motor breaks down under this abuse?

Nothing is there to absorb or deaden the shock—the delicate mechanism of the motor has to bear the full punishment of every blow.

Engineers, recognizing this fact, are now recommending group drives with leather belts, in place of the individual direct connected motor.

G & K belts have just enough elasticity or "give" to absorb these shocks and save the motor. Consequently, motors last longer and are kept in good condition so that they turn out more work.

In addition to these advantages, G & K belts transmit the full rated power of the motor, and serve faithfully for years.

G & K belts have been designed for your drives by engineers who have gone into your industry and know what your belting has to do.

Book 101M specifies the correct belt for each drive. A copy will be gladly sent on request.

This trademark is the symbol of the scientific control of tanning and manufacturing processes and the application of the correct belt for every drive in every industry.

The Graton & Knight Mfg. Co.

WORCESTER, MASS.

Oak Leather Tanners, Makers of Belts and Other Leather Products

Distributors and Branches in All Principal Cities

16

Graton & Knight

Standardized Series Leather Belting

Tanned by us for belting use

IN the bearings sponsored by **SKF** its type of anti-friction bearings have been developed to their highest perfection. And **SKF** further provides an engineering service not only to assure to itself proper application and use of **SKF** marked products but to help the buyer to fully capitalize the mechanical value built into each device. This service is freely offered and is being continually broadened and advanced by laboratory research that is international in scope. You are assured a similar service behind every product bearing the mark—

SKF

Among these products now offered are:

Single row deep groove ball bearings.
Double row self aligning ball bearings.
Steel balls.
Transmission equipment.

SKF Industries, Inc.
165 Broadway, New York City

Supervising at the request of the stockholders
The Hess-Bright Manufacturing Co.
SKF Ball Bearing Co.
Atlas Ball Co.
Hubbard Machine Co.
SKF Research Laboratories

***SKF** Research Laboratory established at Philadelphia to co-operate with the big Gothenburg Laboratories in the study of the American Manufacturers' friction problems.*

617

Moo

When a Hindu gets seriously ill, his folks carry him to the Ganges river. There, with his body almost wholly immersed and his Moo (mouth) half filled with the sacred water, he sometimes lies for days waiting for deliverance.

He gets it!

When the brush troubles in the station grow so serious that the operator feels like taking a month's vacation in a sanatarium, then it's time to take a mouthful of sound advice from a Morganite prescriber.

It's the only way to get deliverance because—

No two sets of operating conditions are alike and no single brush can satisfy two types of service. Hence the Morganite way of making individual brushes for specific cases. It is the only sensible way.

You can prove it at our risk.

Morganite Brush Co., Inc.

Main Office and Factory: 519 West 38th St., New York

DISTRICT ENGINEERS AND AGENTS:

Lewis & Roth, 13th and Wood Sts., Philadelphia

Electrical Engineering & Mfg. Co., First National Bank Bldg., Pittsburgh

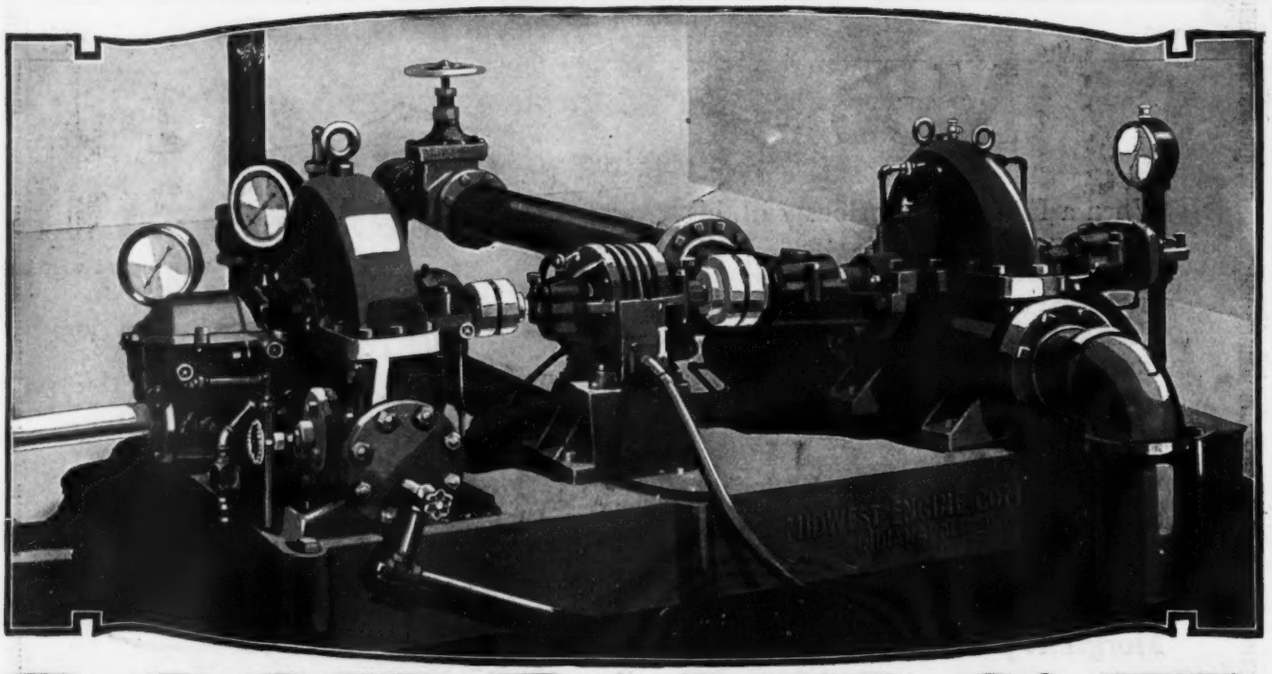
R. W. Lillie Corporation, 176 Federal St., Boston, Mass.

W. R. Hendrey Co., Hodge Bldg., Seattle

Herzog Electric & Engineering Co., 150 Steuart St., San Francisco

Charles Farnham, I. W. Hellman Bldg., Los Angeles

Railway & Power Engineering Corporation, Ltd., 131 Eastern Ave., Toronto, Ontario, Canada



MIDWEST TURBINES

High Duty Pumping Plants Require Midwest Turbines

High priced coal makes every pound of steam that can be saved a net profit against your operating cost. Where you need exhaust steam for feed water heaters, Midwest Engineers can design a turbine which will use the required amount of steam and save the surplus coal used where conditions are not balanced.

Where steam heat is needed you can use your Midwest Turbines as reducing valves to your heating system, thereby getting your heat at a minimum cost.

Midwest Turbines and Pumps have the combined qualities of extreme simplicity and highest economy.

Complete information on request.

Midwest Engine Co., Indianapolis, U. S. A.

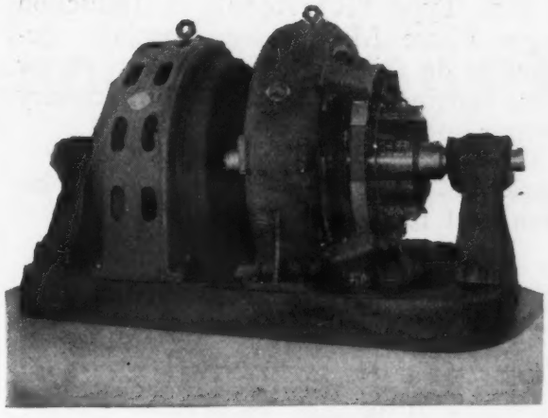
Birmingham	Denver	New York City	Salt Lake City
Baltimore	El Paso	New Orleans	St. Louis
Boston	Houston	Philadelphia	St. Paul
Cleveland	Kansas City	Pittsburg	Seattle
Chicago	Los Angeles	San Francisco	Tulsa
	Little Rock		

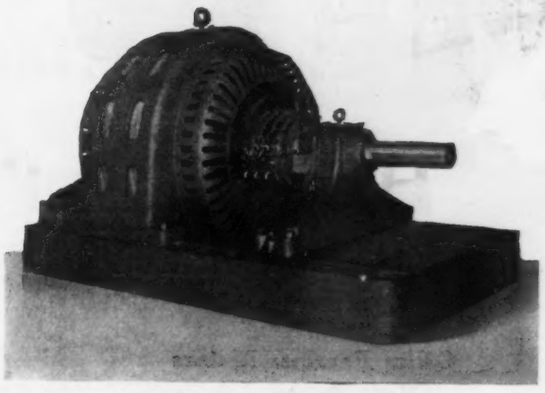
DEPENDABLE POWER

CROCKER-WHEELER MOTORS

"Niagara's Rival for Dependable Power"

C-W Quality Motors are Installed in Plants of Industrial Leaders





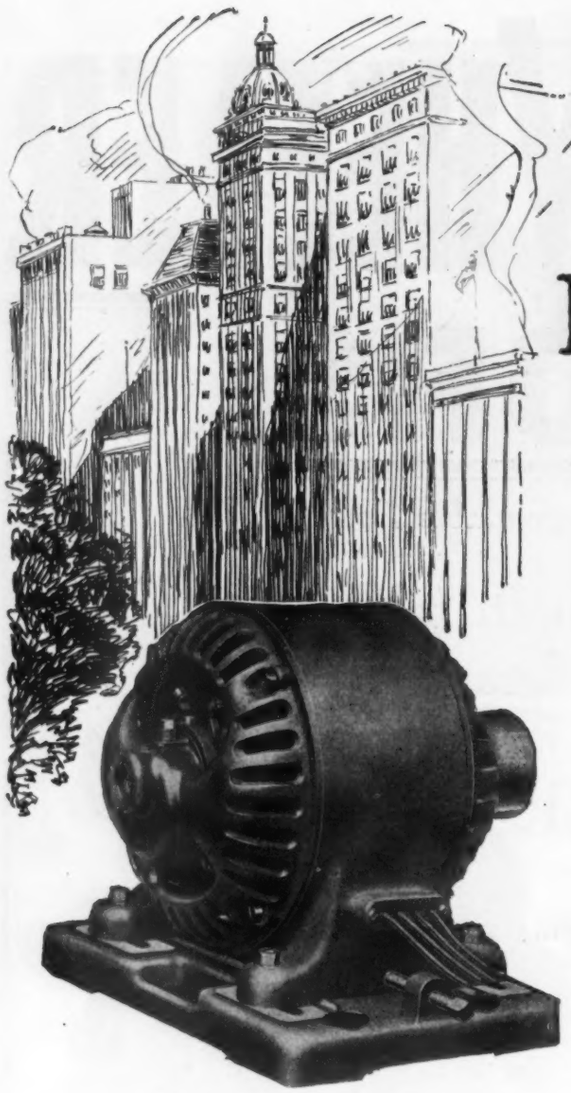
The Pittsburgh Steel Products Company are consistent believers in high grade apparatus. At their plant in Monesson, Pa., this Company uses C-W 500 kw. Motor Generators and 500 h.p. Induction Motors, together with over 100 C-W Motors of various sizes throughout their plant.

MANY of America's greatest manufacturers attest their confidence in the quality of C-W Motors by using the C-W product in their plants. These motors are virtually *production insurance* in that their dependability means the continuous operation of machinery. Also, C-W Motors by helping to avoid shut downs aid materially in retaining efficient workmen.

CROCKER-WHEELER COMPANY

New York Chicago Pittsburgh Philadelphia
Boston Cleveland **AMPERE, NEW JERSEY** *Newark Baltimore*
Syracuse Birmingham New Haven San Francisco

Foreign Sales Distributors
INTERNATIONAL WESTERN ELECTRIC COMPANY, INC.
195 Broadway, New York, U. S. A.



Below the Office Buildings-

ALTHOUGH inconspicuous, the part which Peerless motors are playing every day below the office buildings of the country in driving circulating pumps, air compressors, air cleaning systems, etc., is nevertheless important.

In fact Type "R" Repulsion Induction Single Phase Motors are especially designed to do this class of work. One throw of the starting switch is the only necessary starting operation.

Peerless Motors on the job are *positive assurance* of reliable service.

You will be interested in Bulletin No. 200. It tells the whole story of Type "R." *Send for it.*

Other Peerless Motors

D. C.

Multipolar Motors and Generators.
Sizes up to 35 H.P.
Bipolar Motors and Generators.
Sizes up to 2 H.P.
Low Voltage Motors and Generators.

A. C.

Poly-Phase Motors.
Split-Phase Motors.
Single-Phase Repulsion Induction Motors.
Synchronous Motors.
Motor Generator Sets.
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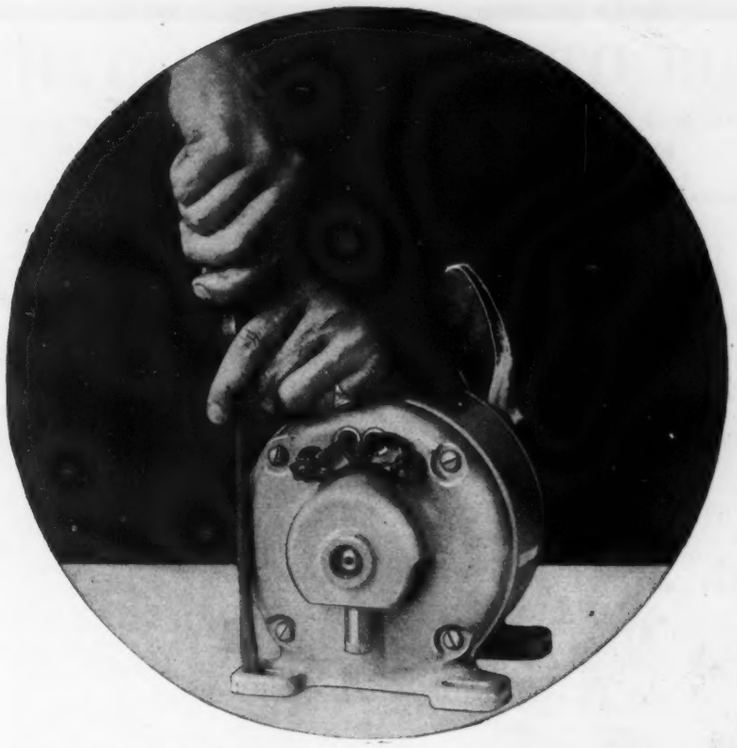

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The slots in the feet of Twin-R, the Small Motor of Quality, are so placed that you can easily fasten the motor down with bolts, cap-screws or wood screws.

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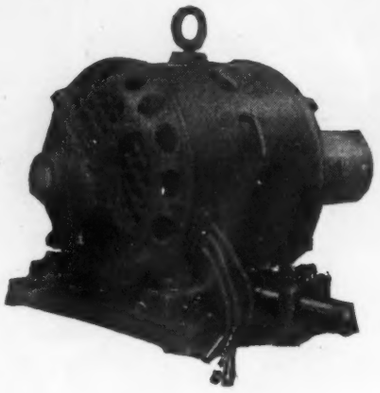

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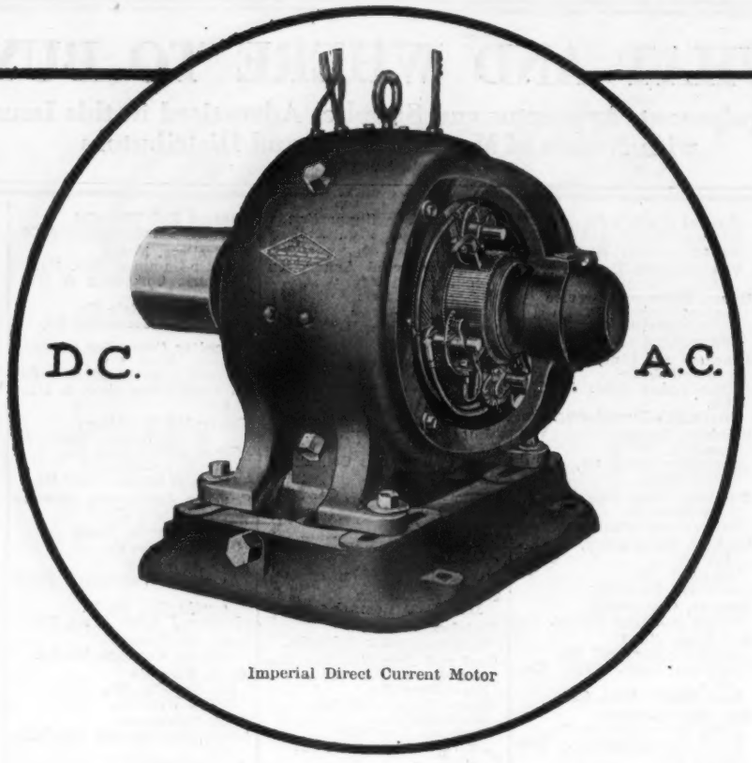

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Goulds Manufacturing Co.
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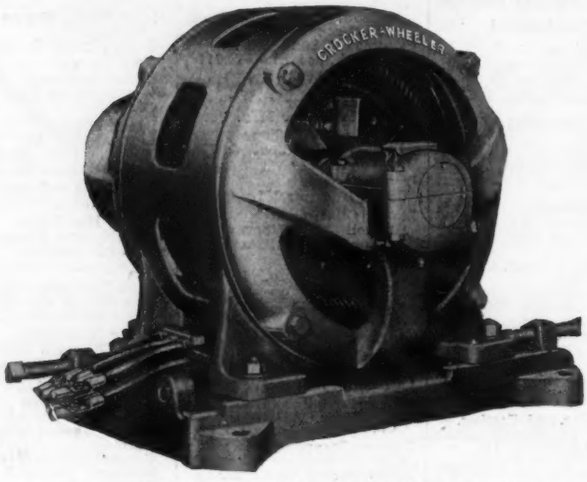

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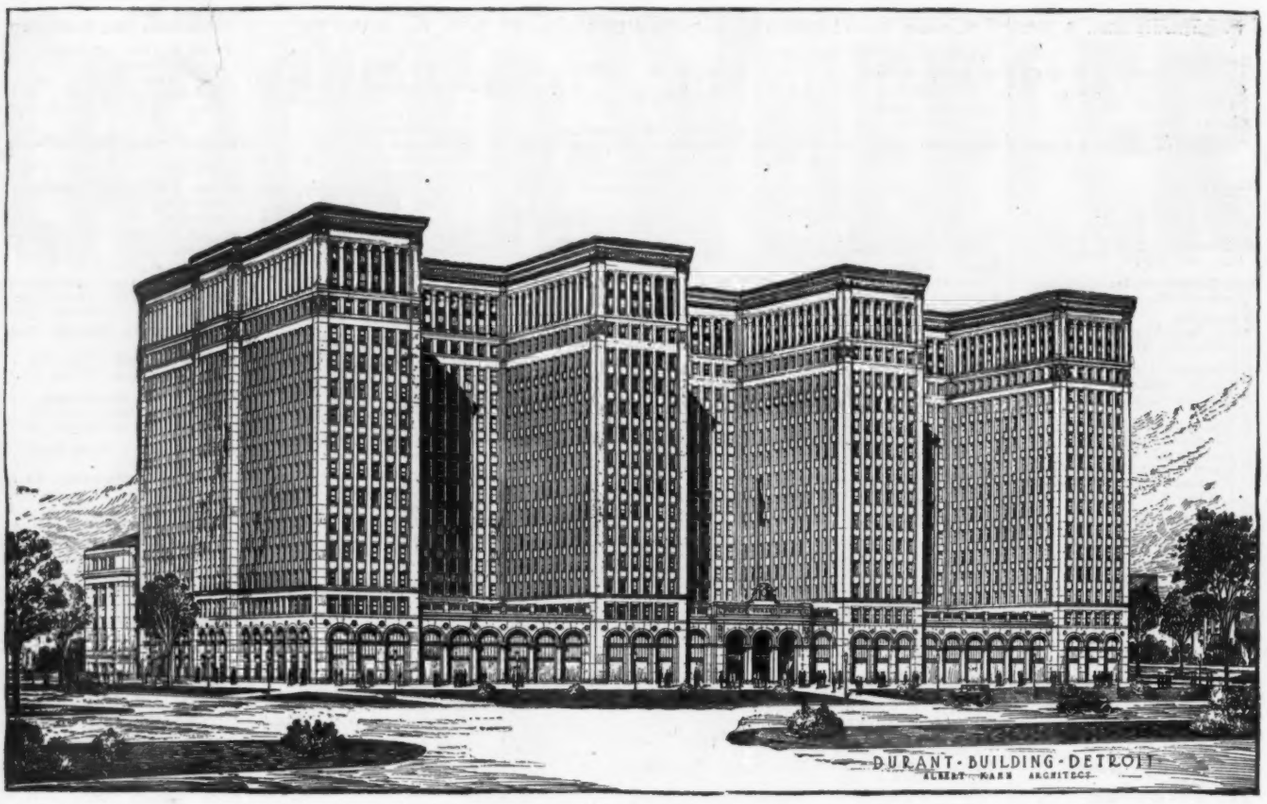

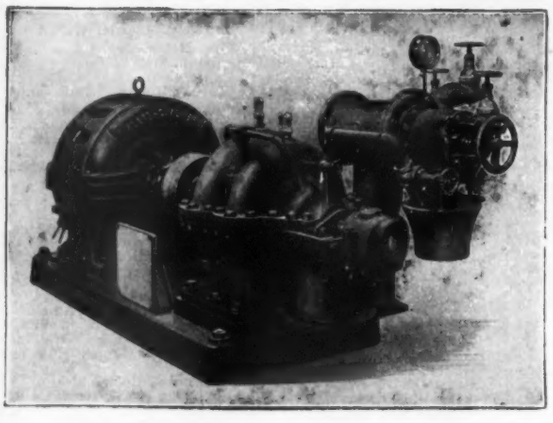

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The Durant Building at Detroit is the home office of the General Motors Corporation. It is said to be the largest office building in the world occupied by one concern. The most modern equipment has been installed in this structure. The centrifugal pumps in this building as well as their driving motors are Allis-Chalmers. These pumps and motors were selected on account of their superior construction and proven reliability. You can do no better than to follow the recommendations of the architects and engineers of the General Motors Corporation and specify Allis-Chalmers equipment when purchasing centrifugal pumps and motors.

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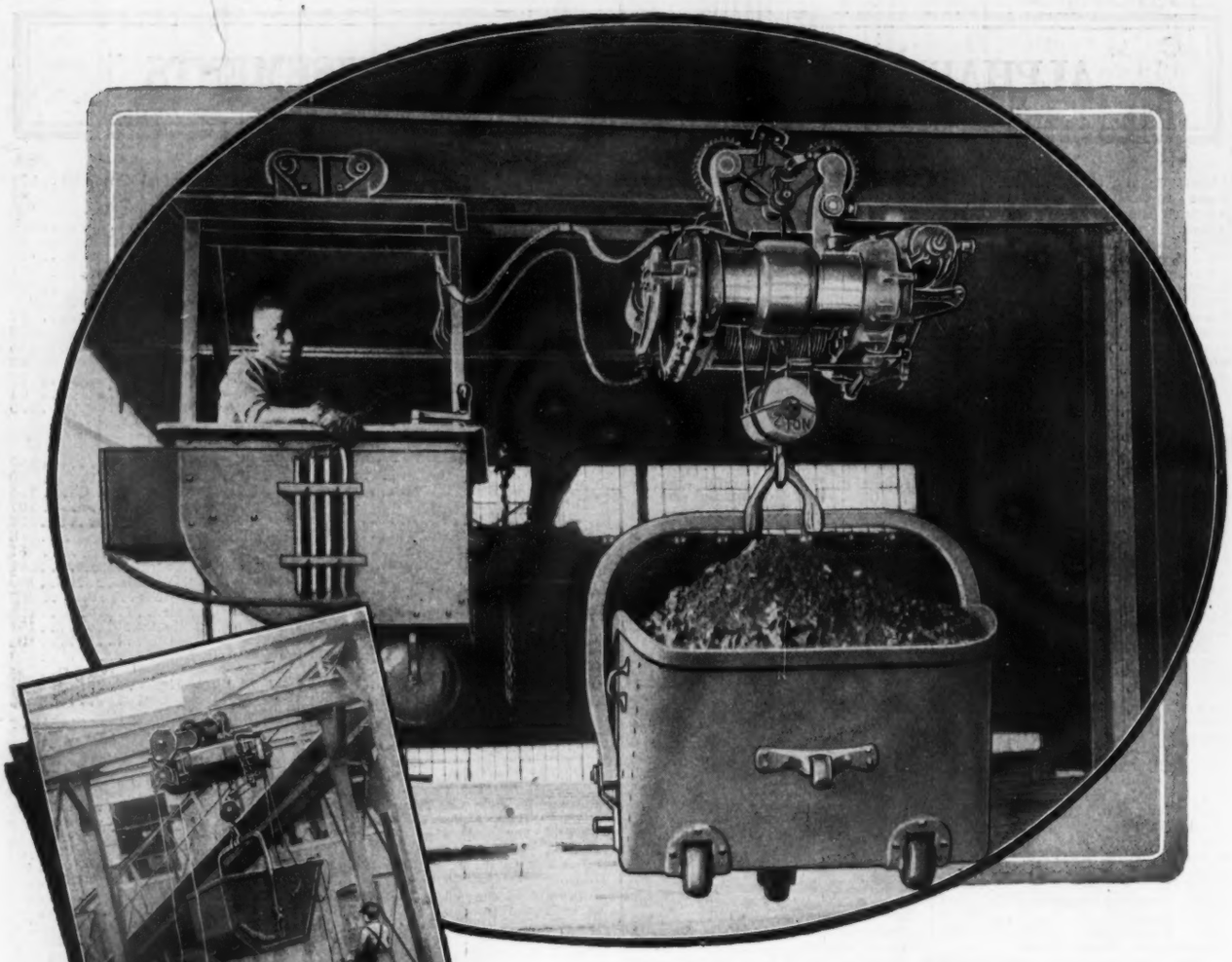
ALLIS-CHALMERS

MILWAUKEE, WIS. U. S. A.

ALPHABETICAL INDEX TO ADVERTISEMENTS

	Page
Abbott, Jr., W. G.	37
Acme Apparatus Co.	108
Advance Electric Co.	106
Aetna Electric Appliance Co.	101
Ajax Electrothermic Corp.	107
Ajax Metal Co.	107
Allis-Chalmers Mfg. Co.	144
Aluminum Co. of America	23
American Circular Loom Co.	96
American Conduit Co.	99
American Engr. Co.	122, 123
American Fixture Co.	98
American Insulating Mach'y Co.	101
American Lava Co.	104
American Radio & Research Corp.	137
American Sheet & Tin Plate Co.	99
American Steel & Wire Co.	99
American Transformer Co.	103
American Vulcanized Fibre Co.	93
Anaconda Copper Mining Co.	103
Anderson Elec. & Equip. Co.	26
Anderson Mfg. Co., A. & J. M.	105
Ansonia Elec'l Co., The	99
Archbold-Brady Co.	105
Archer & Baldwin, Inc.	39
Arnold Co., The	38
Atlantic Ins. Wire & Cable Co.	99
Austin Co., M. B.	107, 110
Automatic Fuel Saving Co.	124, 125
Automatic Reclosing Circuit Breaker Co.	96
Babcock & Wilcox Co.	109
Baehr, William A.	38
Bakelite Company, General	14
Baker & Co., Inc.	94
Baldor Electric Co.	102
Bates Expanded Steel Truss Co.	90
Beaumont Co., R. H.	120
Belden Mfg. Co.	94
Biddle, James G.	91-95
Black & Decker Mfg. Co.	105
Blake, Signal & Mfg. Co.	101
Blaw-Knox Co.	111, 112
Bond Co., Charles	97
Brown Hoisting Machinery Co.	108
Brown-Hunkele Co.	48 57
Burke Electric Co.	102
Busch-Sulzer Bros.—Diesel Eng. Co.	110
Bush Electric Co.	107
Bussmann Mfg. Co.	107
Byllesby & Co., H. M.	36
Caddy Elec. Equip. Co.	62
Cameron Elec. Mfg. Co.	105
Carpenter Tap & Die Co., J. M.	100
Carrell & Co., W. A.	57
Carver Macomber & West, Inc.	36
Castle, Inc., James M.	97
Century Electric Co.	89, 138
Chandeysson Elec. Co.	97
Chicago Electric Co.	52-62
Chicago Electric Lamp Co.	107
Chicago Fuse Mfg. Co.	81
Chicago Ins. Wire & Mfg. Co.	74
Chicago Pneumatic Tool Co.	113
Chuse Eng. & Mfg. Co.	61
Clark & Co., E. W.	36
Cobb Electric Appliance Co.	106
Colonial Fan & Motor Co.	106
Columbus Handle & Tool Co.	109
Combustion Engineering Corp.	128, 129
Commonwealth Edison Co.	59
Comstock & Co., L. K.	60
Condensite Co. of America	104
Condit Electrical Mfg. Co.	15
Consolidated Electric Lamp Co.	109
Consolidated Wire & Mchy Corp.	55
Continental Fibre Co., The	104
Cooper, Hugh L.	36
Copper Clad Steel Co.	103
Corliss Carbon Co.	106
Coto-Coil Company, The	99
Crane Co.	109
Crocker-Wheeler Co.	135, 142
Cutler-Hammer Mfg. Co., The	27
Cutter Co., The	92
D. & G. Dial & Enameling Co.	106
D. & W. Fuse Works	32
Daum, A. F.	107
Davis, J. F.	55
Davis Mach. & Motors Inc.	59
Davis Slate & Mfg. Co.	97
Day & Zimmerman, Inc.	36
Delta Star Electric Co.	24
Dexter Co., I. H.	106
Diamond State Fibre Co.	93
Diddisheim Co., Hipp	100
Diehl Mfg. Co.	102
Directory of Engineers	36-37
Doble Engineering Co.	100
Driver-Harris Co.	107
Dudlo Mfg. Co.	94
Duncan Elec. Mfg. Co.	88
Duquesne Elec. & Mfg. Co.	43, 60-62
Economy Fuse & Mfg. Co.	80
Edge Moor Iron Co.	110
Electric Controller & Mfg. Co.	105
Electric Furnace Construction Co.	107
Electric Motor & Repair Co.	60
Electric Service Supplies	105
Electric Storage Battery Co.	9
Electrical Alloy Co.	99
Electrical Engineers Equip. Co.	105
Electrical Meter Testing Laboratories	36
Electrical Testing Laboratories	36
Electrical World	3
Elliott Co.	28 29
Emerson Elec. Mfg. Co.	102
Engineers, Directory of	36-37
Esselstyn, Murphy & Hanford	36
Estate Stove Co., The	11
Evers & Ballman	36
Fairbanks Co.	53
Fairbanks, Morse & Co.	108
Fansteel Products Co., Inc.	95
Fargo Engineering Co.	36
Ferracute Mach. Co.	100
Fibre Conduit Co.	10
Flexible Woven Cable Co.	103
Ford, Bacon & Davis	36
Formica Insulation Co.	104
Foster Pump Works, Inc.	110
Fowle, Frank F.	36
G. & W. Electric Specialty Co.	30
Gannett, Seelye & Fleming	36
Garfield Mfg. Co.	104
General Bakelite Co.	14
General Electric Co.	33
Gleason & Co., J. L.	100
Goulds Mfg. Co.	114
Graton & Knight Mfg. Co.	131
Green Engineering Co.	126, 127
Green Fire Brick Co., A. P.	110
Gregory Electric Co.	38
Griscom-Russell Co.	121
Guaranteed Motor Co.	62
Habirshaw Elec. Cable Co.	76
Hall & Co., Inc., Stephen	42
Harris Bros.	61
Harris Pump & Supply Co.	44
Hatch, J. N.	36
Hayward Co.	109
Hazard Mfg. Co.	75
Hi-Voltage Equip Co.	105
Hofmann, Alfred	94
Hogan, John R.	112
Hoover Suction Sweeper Co.	20
Hopewell Ins. & Mfg. Co.	73
Hotwat Distributing Co.	107
Howell Elec. Motors Co.	106
Hubbard & Co.	78
Hubbell, Inc., Harvey	82
Huddle, W. J., & Co.	36
Imperial Electric Co.	140
Imperial Porcelain Works	104
Independent Electric Machy. Co.	50
Independent Pneumatic Tool Co.	87
Indiana Rubber & Ins. Wire Co.	34
Industrial Controller Co.	105
International Insulation Corp.	104
International Nickel Co.	108
Irvington Varnish & Insulator Co.	22
Ives & Davidson	36
Jeandron, W. J.	102
Jeffrey-Dewitt Ins. Co.	21, 101
Johns-Manville	12, 13
Kerite Ins. Wire & Cable Co.	34
Kerr Turbine Co.	118
Keystone Die-Casting Co.	107
Kimble Elec. Co.	102
Klein, Nathan	56
Knoeppel & Co., Inc., C. E.	36
Krehbiel Company	36
Kuhlman Elec. Co.	103
Lapp Ins. Co., Inc.	104
Le Carbone Co.	102
Lee, William S.	36
Leffel & Co., James	111
Leslie-Stevens Co.	36
Lewis & Roth Corp.	105
Lincoln, Inc., E. S.	36
Link-Belt Co.	146
Locke Insulator Mfg. Co.	72
Locomotive Superheater Co.	108
Lombard Governor Co.	108
MacGovern & Co., Inc.	47
McGraw-Hill Book Co., Inc.	83
McIntosh & Seymour Corp.	110
McMillan, A.	62
McMullen Mchy Co.	60
Manistee Iron Works Co.	103
Mfg's Equipment Exchange	61
Maris Bros.	109
Markman Engr. Co.	61
Massachusetts Machine Shop, Inc.	108
Matthews & Bro., W. N.	109
Mead, Daniel W.	36
Mechanical Appliance Co.	106
Merrill & Co., M. H.	37
Metropolitan Elecl. Prod. Co.	88
Mica Insulator Co.	101
Midwest Engine Co.	134
Miller-Owen Elec. Co., Inc.	65, 46
Miller Seldon Elec. Co.	59
Minerallic Elec. Co.	104
Mitchell-Rand Mfg. Co.	104
Moloney Electric Co.	86
Monarch Elec. Motor Co.	52
Monarch Refillable Fuse Co.	107
Monitor Controller Co.	103
Moore & Co., W. E.	36
Moorehead Mchy. Co.	54
Morganite Brush Co.	133
Morse Chain Co.	105
Motter's Sons, Geo. F.	58
Mueller Electric Co.	103
Murrell & Co., Wm. G.	37
Myerson, Joseph	40
Nagle Elec Co., W. G.	59
National Fibre & Insulation Co.	103
National Metal Molding Co.	79
National Pipe & Supply Co.	60
National Power Mach'y Co.	58
National Screw & Tack Co	3rd Cover
Neall, N. J.	37
Nelson, I. R.	57
Newark Elec. Repair Co.	61
New England Butt Co.	101
Norma Co. of America	16
Northern Industrial Chem. Co.	104
Nussbaum & Co., V. M.	58
Ohio Brass Co.	96, 103
Ohio Electric & Controller Co.	109
Ohio Utilities Eng. Co.	37
Okonite Co., The	34
Ophuls, Hill & McCreery, Inc.	37
Orangeburg Fibre Conduit Co.	10
Orton & Steinbrenner Co.	109
Oshkosh Mfg. Co.	90
Ostrander & Co., W. R.	87
Packard Electric Co., The	70
Paragon Elec. Co.	100
Parsons, Klapp, Brinkerhoff & Douglas	37
Peerless Electric Co.	136
Pelton Water Wheel Co.	89
Permutit Co.	110
Philadelphia Insulated Wire Co.	105
Phoenix Utility Co.	59
Phonograph Appliance Co.	99
Pickard, Greenleaf W.	37
Pittsburgh Elec. Furnace Corp.	107
Pittsburg High Voltage Insulator Co.	86
Pittsburgh Transformer Co.	17
Power Apparatus Co.	61
Power Equipment Co.	61
Power Machy. Exchange, Inc.	51
Power Specialty Co.	110
Pulverized Fuel Equip. Division	111
Railway & Industrial Engr. Co.	71
Randle Machy. Co.	53
Redmanol Chemical Prod. Co.	101
Reed, W. Edgar	37
Reliance Elec. & Eng. Co.	106
Rensselaer Valve Co.	108
Republic Engineers, Inc.	37
Republic Flow Meters Co.	119
Riley Stoker Co., Sanford	111
Riter-Conley Co.	105
Robbins & Myers Co.	B,C
Robinson & Co., D. P., Co.	37
Rockwood Mfg. Co.	130
Roebling Sons Co., John A.	105
Roller-Smith Co.	92
Rome Wire Co.	77
Ross Power Equip. Co.	61
Roth Bros. & Co.	106
S. K. F. Industries, Inc.	132
Sachsenmaier Co., Geo.	50
Safety Ins. Wire & Cable Co.	104
Samson Cordage Works	107
Sanderson & Porter	37
Sangamo Elec. Co.	8
Sargent & Lundy	37
Sayer, E. Y., Engrg. Corp.	37
Scaife & Sons, Wm. B.	108
Scheidenheim, F. W.	36
Scheinert Co., R.	58
Schoonmaker Co., A. O.	104
Schutte & Koerting	108
Schwartz & Land	59
Schweitzer & Conrad, Inc.	75
Scofield Eng'g Co.	37
Searchlight Section	38-99
Shelton Elec. Co.	108
Sherman Mfg. Co., H. B.	98
Simplex Wire & Cable Co.	34
Smith, C. E., & Co.	37
Smith, S. Morgan, Co.	115
Smith and Serrell	103
Spaulding Elec. Co.	59
Spilger Elec. Co.	49
Sprague Electric Works	18
Spray Engineering Co.	108
Standard Underground Cable Co.	105
Star Electric Motor Co.	106
Star Expansion Bolt Co.	107
States Co., The	95
Steward Mfg. Co., D. M.	104
Stewart Mfg. Corp.	85
Stewart & Co., Paul	51
Stewart Elec. Co., John A.	82, 54
Stone & Webster	37
Stromberg-Carlson Tel. Mfg. Co.	98
Sturtevant Co., B. F.	106
Sundh Electric Co.	105
Syracuse Supply Co.	45
Taylor Instrument Companies	106
Terry Steam Turbine Co.	108
Thomas & Sons Co., R.	96
Tiffany Hall & Co.	41
Trumbull Elec. Mfg. Co.	100
Trumbull Vanderpoel Elec. Mfg. Co.	106
Trump Mfg. Co.	108
Under-Feed Stoker Co. of America, The	108
United States Graphite Co.	102
Universal Utilities Corp.	19
Valley Electric Company	102
Viele, Blackwell & Buck	37
Wagner Elec. Mfg. Co.	Front Cover
Ward Leonard Electric Co.	31
Weightman, Hugh E.	37
Werby & Co., A.	59
Wesche Electric Co., B. A.	106
Western Electric Co.	7
Westinghouse Elec. & Mfg. Co.	4, 5, 6
Weston Electrical Instrument Co.	2
Wheeler Condenser & Eng. Co.	110
White Engineering Corp., J. G.	37
Wickes Mchy. Co.	62
Williams, Gardner S.	37
Willey Wray Elec. Co.	59
Wilmington Fibre Spec. Co.	104
Wilson Co., H. A.	95
Wonder Spool Co.	104
Woodward Governor Co.	108
Wooten Co., L. E.	106
Worthington Pump and Mach'y Corp.	116, 117
Wray & Co., J. G.	37



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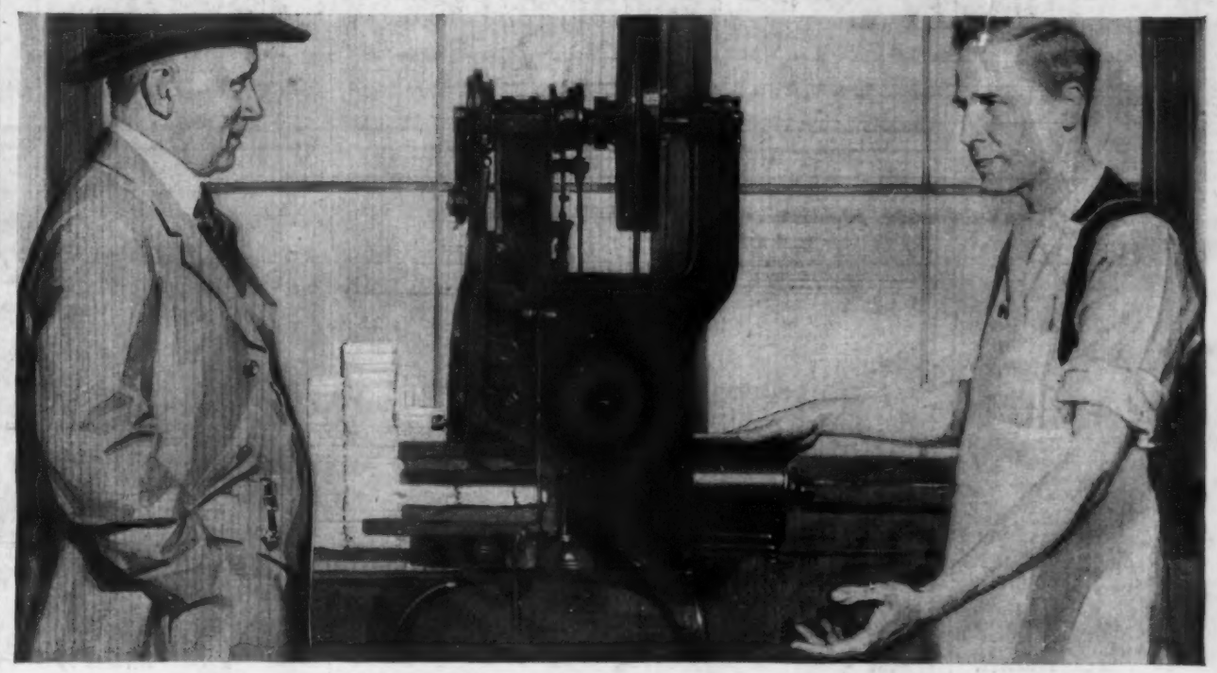

15 Years of Continuous Service and Not One Minute of Lost Time

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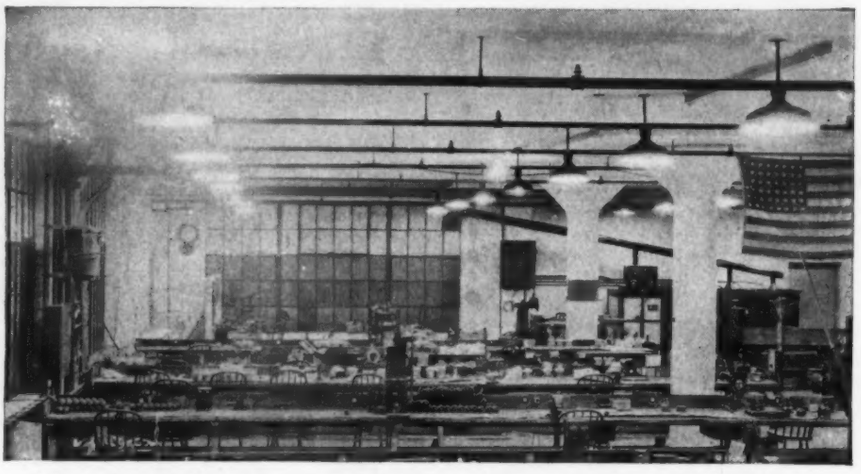

Interior view of the Van Dorn Electric Tool Company Plant, Cleveland. ABolites installed by the Merrell-Sharp Electric Company, Electrical Contractors, Cleveland.

It's Evident That There's Good Light Here

The trim business-like appearance suggests it—suggests good work—suggests efficiency.

ABolites are chosen for their efficiency. Good lighting protects workmen's eyes, decreases spoilage, means less accidents, better work and more production. Quality products of the Van Dorn Electric Tool Company are a witness to this fact.

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